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ABSTRACT

These instructor materials for an aviation maintenance technology course contain three instructional modules covering safety, aviation mathematics, and aviation physics. Each module may contain an introduction and module objective, specific objectives, an instructor's module implementation guide, technical information supplements, transparency masters, workbook supplements, answers to workbook supplements, a theory test, project guides, answers to the theory test, and a practical test. These materials were developed through a cooperative effort of airframe and powerplant mechanics, general aviation industry representatives, Federal Aviation Administration representatives, and vocational educators in Oklahoma to provide a comprehensive program in aviation maintenance technology. (KC)

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AVIATION MAINTENANCE TECHNOLOGY

GENERAL

G101 AVIATION MATHEMATICS AND PHYSICS

INSTRUCTOR MATERIAL

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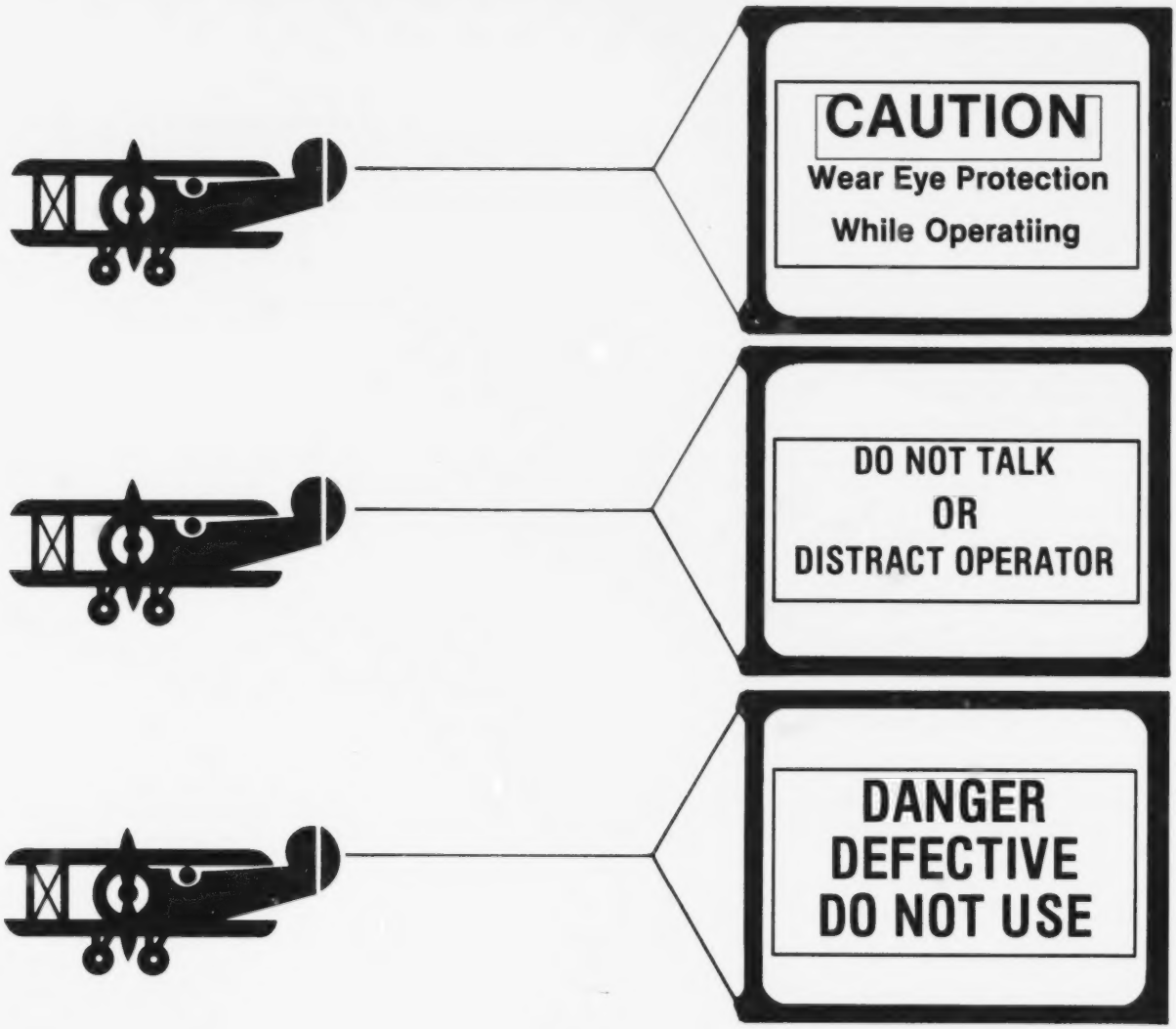
MODULE OF INSTRUCTION
FOR
AVIATION MAINTENANCE TECHNOLOGY

SAFETY
S101 GENERAL HANGAR AND SHOP SAFETY
IDENTIFY HANGAR AND SHOP SAFETY HAZARDS
S101-A



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MODULE CONTENTS

A. Introduction and Module Objective

B. Specific Objectives

C. Instructor's Module Implementation Guide

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D. Technical Information Supplement #1 - General Hangar and Shop Safety

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2. TM #2 - Caution Signs
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5. TM #5 - Danger Tag
6. TM #6 - Caution Tag
7. TM #7 - Out-of-Order Tag
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9. TM #9 - The Fire Triangle
10. TM #10 - Types of Fire Extinguishers
11. TM #11 - Fire Extinguisher Operations
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3. Workbook Supplement #3 - Discuss Steps to be Followed in Case of an Accident

4. Workbook Supplement #4 - Complete an Accident Report Form

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I. Answers to Theory Test

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INTRODUCTION

Due to the nature of work in the aerospace industry, one must be continually aware of the many possible safety hazards. Most accidents occur in places where obvious safety hazards are allowed to exist. By being aware of general safety precautions and possible safety hazards, many accidents, as well as the loss of life, can be prevented.

MODULE OBJECTIVE

Upon completion of this module, you will be able to discuss proper hangar and shop safety precautions, identify safety hazards, and complete an accident report. You will demonstrate this knowledge by completing the procedures outlined in the workbook assignments. You will further demonstrate this knowledge by scoring 85 percent on the module theory test.

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SPECIFIC OBJECTIVES

After completion of this module, you will be able to:

(NOTE: The numbers in parentheses at the end of each specific objective indicate the competency level for that objective.)

1.	Match terms associated with general hangar and shop safety to their correct definitions. (1)	Technical Supplement #1
2.	List basic safety objectives. (1)	Technical Supplement #1
3.	Select proper safety attitudes. (1)	Technical Supplement #1
4.	Select general safety precautions. (1)	Technical Supplement #1
5.	Select statements concerning effects of safety on organization, equipment, and maintenance. (1)	Technical Supplement #1
6.	List causes of accidents. (1)	Technical Supplement #1
7.	List steps in maintaining a clean and orderly shop. (1)	Technical Supplement #1
8.	Complete statements concerning hangar safety. (1)	Technical Supplement #1
9.	Match safety color codes to their correct applications. (1)	Technical Supplement #1
10.	Match accident prevention signs and tags to their colors and uses. (1)	Technical Supplement #1
11.	Match classes of fire to their correct descriptions. (1)	Technical Supplement #1
12.	Label and define components of the fire triangle. (1)	Technical Supplement #1
13.	Match types of fire extinguishers to classes of fire on which they are used. (1)	Technical Supplement #1
14.	Match types of fire extinguishers to their recommended operations. (1)	Technical Supplement #1

SPECIFIC OBJECTIVES

15.	Select true statements concerning fire safety rules. (1)	Technical Supplement #1
16.	Arrange in order steps in lifting heavy objects. (2)	Technical Supplement #1
17.	Select proper steps to follow in case of an accident. (1)	Technical Supplement #1
18.	Complete a student safety pledge. (3)	Workbook Supplement #1
19.	Complete hazard check of hangar and shop area. (3)	Workbook Supplement #2
20.	Discuss steps to be followed in case of an accident. (3)	Workbook Supplement #3
21.	Complete an accident report. (3)	Workbook Supplement #4

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INSTRUCTOR'S MODULE IMPLEMENTATION GUIDE

I. Order materials to supplement module

A. Pamphlets

1. Lift Safely. Recommended: One per student.

2. How Good Housekeeping Helps You. Recommended: Minimum one for every two students.

3. Facts About Backs. Recommended: One per student.

4. The Disablers: Know Your Four Worst Enemies. Recommended: Minimum one for every two students.

5. Protect Your Eyes. Recommended: One per student.

6. Using Hand Tools and Portable Power Tools Safely. Recommended: One per student.

(NOTE: The above pamphlets are available from the National Safety Council, 444 North Michigan Avenue, Chicago, Illinois 60611.)

7. 10 Good Reasons to Protect Your Hands. Recommended: One for every two students. Available from Channing L. Bete Co., Inc., Greenfield, Massachusetts 01301.

8. This is How Most Fire Extinguishers Work. Recommended: One per every two students. Available from National Fire Protection Associates, Batterymarch Park, Quincy, Massachusetts 02699.

B. Films

1. Safety Attitude.

2. Safety Odds of See...Think...Do.

3. A New Way to Lift.

4. Using Fire Extinguishers.

(NOTE: These films are available from the National Safety Council, 444 North Michigan Avenue, Chicago, Illinois 60611.)

5. Moods in Safety.

(NOTE: Available from National Audiovisual Center, National Archives and Records Service, General Services Administration, Washington, DC 20409.)

C. Safety Stickers

(NOTE: Safety stickers are available from the National Safety Council, 444 North Michigan Avenue, Chicago, Illinois 60611; or, from the State Department of Vocational and Technical Education, Curriculum and Instructional Materials Center, 1500 West Seventh, Stillwater, OK 74074.)

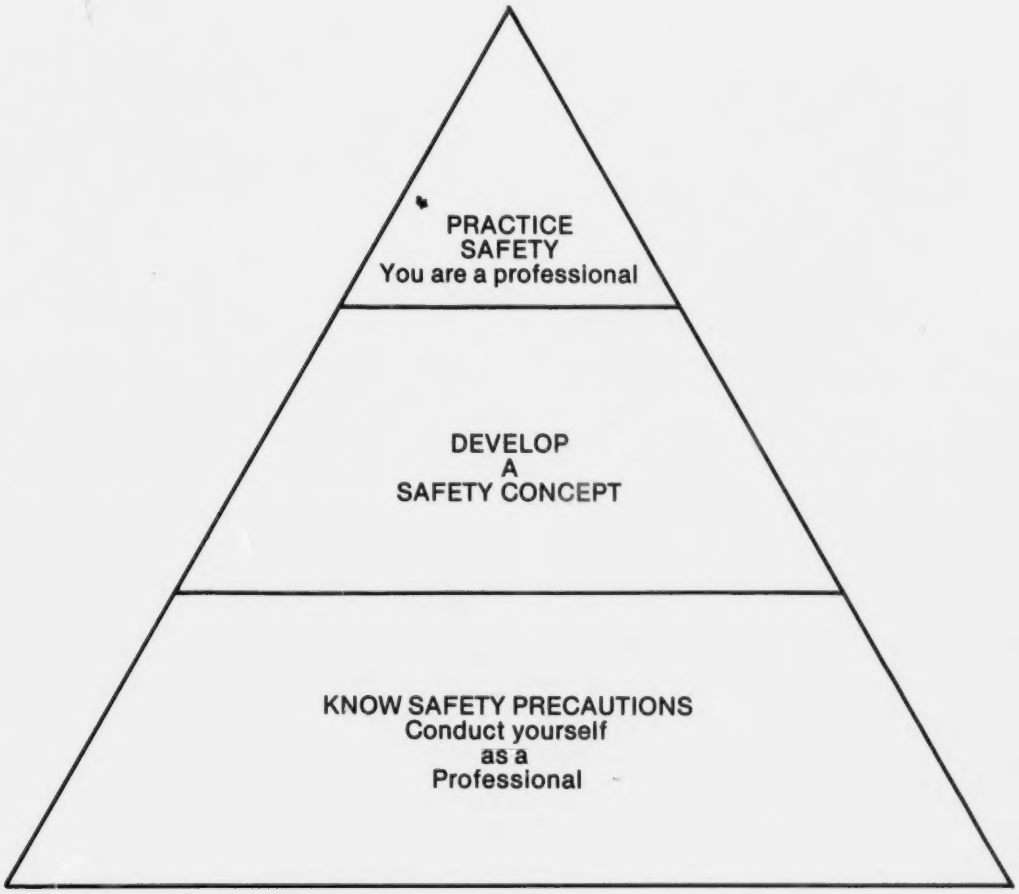
II. Implementation Suggestions

Estimated Teaching Time		Theory	Lab
Objective 1	Discuss Objective 1. Stress the importance of common terms for the aviation industry.		
Objective 2	Before discussing Objective 2, make copies for students of Instructional Supplement #1 - The Safety Objective Pyramid. This can be enlarged for the bulletin board. Place the appropriate section of the pryamid on the bulletin board as you discuss each safety objective.		
Objective 3	Dicuss Objective 3. Emphasize why it is important to develop a proper safety attitude. Show the films Safety Attitudes and Moods in Safety.		
Objective 4	Discuss Objective 4. Give as many examples as possible where safety precautions are imperative. Use pamphlets The Disabler, Protect Your Eyes, and 10 Good Reasons to Protect Your Hands.		
Objectives 5-6	Invite an industry representative to make a presentation on the causes of accidents and how organization, equipment, and maintenance practices affect safety. Discuss Objectives 5 and 6. For supplemental reading use pamphlet Using Hand Tools & Portable Power Tools Safely. Show film Safety Odds to See...Think... Do.		

Estimated Teaching Time		Theory	Lab
Objective 7	Discuss Objective 7. Emphasize the instructor's specific safety rules. Pass out the pamphlet, How Good Housekeeping Helps You. Conduct a shop safety tour. Assist students as necessary. Have students complete questions in the pamphlet.		
Objective 8	Discuss Objective 8. Emphasize the special hazards related to the hangar.		
Objectives 9-10	Discuss Objectives 9 and 10. Show examples of several different types of safety stickers and tags. Use Transparency Masters #1 - #7.		
Objective 11	Discuss Objective 11. Emphasize the importance of knowing each class of fire. Show Transparency Master #8.		
Objective 12	Discuss Objective 12. Point out the function of each of the three parts of the fire triangle. Show Transparency Master #9.		
Objective 13-14	Discuss Objective 13-14. Explain the importance of using the correct type of fire extinguisher for a class of fire and why caution should be taken to use correct operating procedures. Use Transparency Masters #10 - #12. Show film, Using Fire Extinguishers.		
Objective 15	Discuss Objective 15. Make available to students the telephone number of the nearest fire department and building evacuation plan; conduct a fire drill.		
Objective 16	Discuss Objective 16. Pass out pamphlet Lift Safely. Have students complete the pamphlet. Show film A New Way to Lift. Provide students with pamphlet Facts About Backs.		

Estimated Teaching Time		Theory	Lab
Objective 17	Discuss Objective 17. Emphasize the importance of following the proper steps if an accident occurs.		
Objectives 18-21	Explain Workbook Supplements #1 - #4 and have students complete them. Assist students as necessary.		

INSTRUCTIONAL SUPPLEMENT #1 - Safety Objective Pyramid



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TECHNICAL INFORMATION SUPPLEMENT #1 - General Hangar and Shop Safety

I. Terms and definitions

A. Safety - State or condition of being safe; freedom from danger, risk or injury

B. Accident - Any suddenly occurring, unintentional event which causes injury or property damage

C. Hazard - Potential source of danger

II. Safety objectives

A. Know safety precautions

B. Develop a safety concept

C. Practice safety

III. Proper safety attitudes

A. Always be alert for unsafe practices, tools, and conditions

B. Understand all safety rules

C. Obey all safety rules

D. Make safety a constant concern

E. Have proper training in how to use equipment and tools before using them

F. Report all accidents, no matter how small

(NOTE: Prompt reporting of all accidents will reduce hazards.)

IV. General safety precautions

A. Keep all hand tools sharp, clean, and in safe working order

B. Do not use any defective tools, machines, or equipment

C. Retain all guards and safety devices

D. Make sure all guards and barriers are in place and adjusted properly

E. Operate equipment only after receiving proper operating instructions

F. Operate equipment and machines only when given permission by instructor

G. Operate machines only in the presence of an instructor

H. Check all equipment before turning on switches

I. Turn off the power and wait for equipment or machine to completely stop before leaving machine or equipment

J. Do not touch belts or pulleys while machines are in operation

K. Stop machines before adjusting

L. Always clean chips from a machine with a brush

(CAUTION: Do not use a towel, bare hands, or compressed air.)

M. Disconnect power from machine tools before performing maintenance tasks, such as oiling or cleaning

N. Use proper tools and equipment for each job

O. Store tools properly when not in use

P. Do not put tools in pockets of clothing

Q. Use correct, properly fitting wrenches for nuts, bolts, and objects to be turned or held

R. Report all accidents to the instructor, regardless of nature or severity

S. Record all accidents in writing

T. Report any conditions that may lead to an accident

U. Give all injuries prompt attention

V. Always work with adequate lighting

W. Do only approved work in the shop

X. Conduct yourself in a safe manner at all times

Y. Keep the shop floor clear of scraps and litter

Z. Clean up any spilled liquids immediately

AA. Store oily shop towels or oily waste in metal containers

BB. Use a solvent only after determining its properties, what kind of work it has to do, and how to use it

CC. Do not try to repair electrical parts or damages; report them to the instructor

DD. Operate a machine or its switch alone when working in pairs

EE. Always wear safety glasses, goggles, or face shields when operating high-speed power tools

FF. Do not try to repair electrical parts or damages; report them to the instructor

GG. Observe all safety zones

HH. Know locations of fire extinguishers, exits, and fire drill procedures

II. Use proper lifting techniques when lifting heavy objects

(NOTE: Lift with legs, hips, and back as straight as possible; get help.)

JJ. When in doubt about anything, ask the instructor

KK. Do not wear jewelry, ties, or loose-fitting clothing when working with moving equipment

V. Effects of safety on organization, equipment, and maintenance

A. Instructor shall not leave the work area during class time

B. All power and hand tools shall be kept sharp and in good working condition

C. Brightly colored safety zones shall be painted around power tools

D. Floors shall frequently be swept clean of sawdust and scrap material; scrap boxes shall be placed near power tools

E. Adequate lighting, ventilation, and dust removal shall be provided; fume and vapor removal shall also be provided

F. Materials shall be stored in such a way that they will not be tripping hazards

G. Flammable liquids shall be stored in safety-type containers, and only limited amounts shall be kept on hand

H. Stairways shall be kept clear and well-lighted

I. Fire extinguishers of the proper types shall be located in convenient places but not in likely fire areas

J. Electrical circuits shall not be overloaded

K. All electrical cords shall be checked at regular intervals and replaced or repaired as necessary

(NOTE: Make sure that a knot is tied after connecting two electrical cords. Failure to do this could result in a spark.)

L. All power tools, whether portable or fixed, shall be grounded

M. All power tools, benches, and other equipment shall be located in areas providing ample space with accident prevention in mind

N. Lockers shall be inspected regularly for cleanliness and fire hazards; locker doors shall be kept closed

O. Dangerous materials shall be stored in metal cabinets

P. An adequately stocked first-aid cabinet shall be provided

Q. Be sure to inventory all tools and equipment, so that none are left in aircraft.)

Q. All tools and equipment shall be inventoried so that none are left in aircraft

VI. Causes of accidents

A. Unnecessary risk-taking

B. Rushed or hurried work

C. Showing off

D. Lack of information

E. Preoccupation of mind

F. Distraction of attention

G. Fear

H. Experimentation

I. Failure to follow instructions

J. Poor discipline

K. Defective machinery

L. Improperly guarded machinery

M. Faulty layout

N. Faulty installation

O. Defective materials or equipment

P. Excitement

Q. Selfishness

R. Improper clothing

S. Poor health

T. Unsafe machinery conditions

(NOTE: Twenty percent of all accidents involve unsafe machinery conditions.)

U. Unsafe human actions

(NOTE: Seventy-eight percent of all accidents are a result of unsafe human actions.)

V. Acts of nature

(NOTE: Two percent of accidents are a result of acts of nature.)

VII. Steps in maintaining a clean and orderly shop

A. Arrange machinery and equipment to permit safe, efficient work practices and ease in cleaning

B. Store materials and supplies safely in proper places

C. Store tools and accessories safely in cabinets, on racks, or other suitable devices

D. Keep work areas and work benches clean and free of debris and other hazards

E. Keep floors clean and free from obstructions and slippery substances

F. Keep aisles, traffic areas, and exits free of excess materials and other debris

G. Dispose of combustible materials properly or store in approved containers

H. Store oily towels in approved metal containers

I. Make sure that students working in the area know proper procedures to follow in keeping the area clean and orderly

J. Make available sufficient brooms, brushes, and other housekeeping equipment

K. Keep drinking fountain and washing facilities clean and neat at all times

VIII. Hangar safety

A. Be aware of oil and flammable materials spills

B. Do not move aircraft propellers

(NOTE: Any movement of the propeller could result in the engine starting.)

C. Be alert to any aircraft movement

D. Do not move aircraft without wing walkers

E. Never smoke in the hangar area

(NOTE: Smoking is prohibited in the hangar area at all times.)

F. Position ladder stands correctly

IX. Applications of safety color codes

A. Federal safety red

1. Location of firefighting equipment

2. Portable containers of flammable liquids

3. Emergency stop bars, stop buttons, and emergency electrical stop switches on machinery

B. Federal safety yellow

1. Caution and physical hazards

2. Waste containers for explosive or combustive materials

3. Caution against starting, using or moving equipment under repair

4. Identification of the starting point or power source on machinery

C. Federal safety orange

1. Dangerous parts of machines

2. Safety starter buttons and parts of equipment that may cause electrical shock

3. Exposed edges of pulleys, gears, rollers, cutting devices and power jaws

D. Federal safety purple - Radiation hazards

E. Federal safety green

1. Safety

2. Location of first-aid equipment

(NOTE: This applies to equipment other than firefighting equipment.)

F. Federal safety black and federal safety white

(NOTE: Black and white are used individually or in combination.)

1. Traffic flow

2. Housekeeping purposes

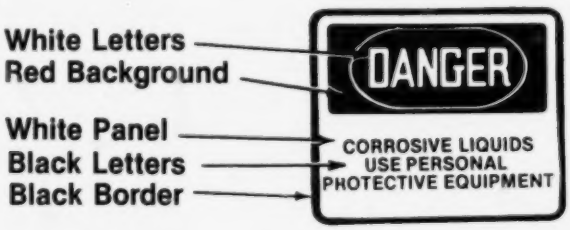
X. Accident prevention signs and tags, their colors, and uses

A. Danger signs

1. Used where an immediate hazard exists

2. Colors are red, black and white (Figure 1)

FIGURE 1

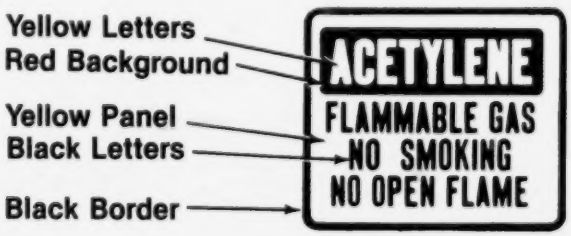


B. Caution signs

1. Used to warn against potential hazards or to caution against unsafe practices

2. Colors are yellow and black (Figure 2)

FIGURE 2

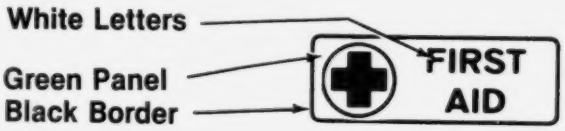


C. Safety instruction signs

1. Used where there is a need for general instruction and suggestions relative to safety measures

2. Colors are white, green and black (Figure 3)

FIGURE 3

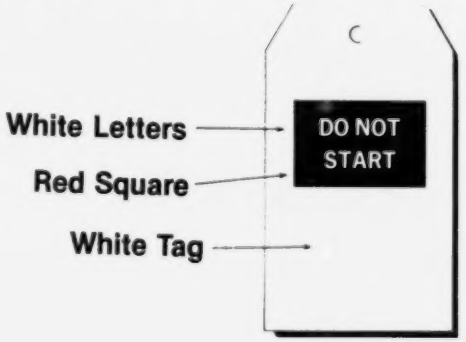


D. Do-not-start tags

1. Are placed at the starting mechanism which would cause hazardous conditions should the equipment be energized

2. Colors are red and white or gray (Figure 4)

FIGURE 4

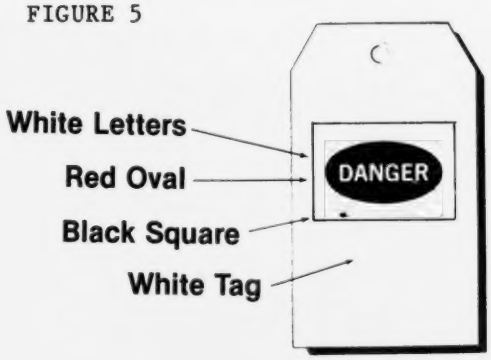


E. Danger tags

1. Are placed only where an immediate hazard exists

2. Colors are red, black and white (Figure 5)

FIGURE 5

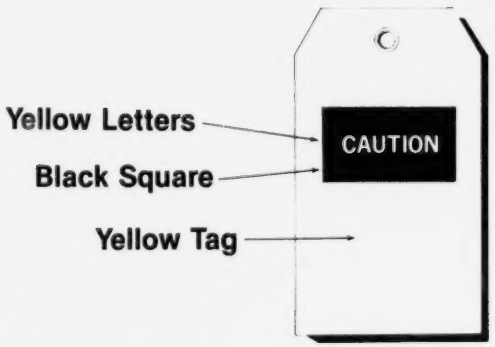


F. Caution tags

1. Are used to warn against potential hazards or to caution against unsafe practices

2. Colors are yellow and black (Figure 6)

FIGURE 6

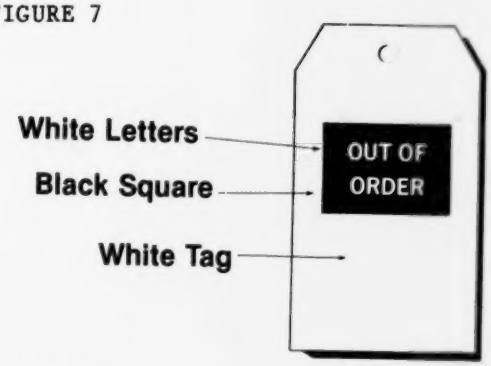


G. Out-of-order tags

1. Are used to identify pieces of equipment that are out of order

2. Colors are blue and white (Figure 7)

FIGURE 7



XI. Classes of fires

A. Class A - Fires that occur in ordinary combustible materials

Examples: Wood, rags and rubbish

B. Class B - Fires that occur with flammable liquids

Examples: Gasoline, oil, grease, paints and thinners

C. Class C - Fires that occur in, or near electrical equipment

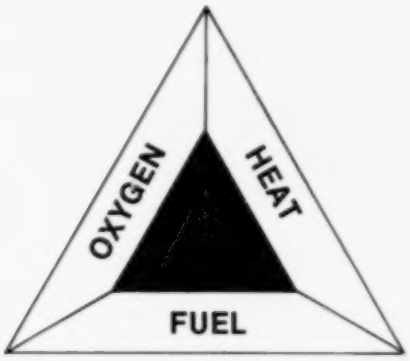
Examples: Motors, switchboards and electrical wiring

D. Class D - Fires that occur with combustible metals

Examples: Magnesium

XII. Components of the fire triangle (Figure 8)

FIGURE 8



A. Fuel - Any combustible material

B. Heat - Enough to raise the fuel to its ignition temperature

C. Oxygen - Necessary to sustain combustion

XIII. Types of fire extinguishers and classes of fires on which they are used

A. Stored pressure or water pump tank - Used on Class A fires

(NOTE: Operates usually by squeezing a handle or trigger, or by turning a valve.)

B. Soda acid - Used on Class A fires

(NOTE: Operates by turning extinguisher upside down.)

C. Carbon dioxide (CO2) - Used on Class B or C fires

(NOTE: Operates usually by squeezing a handle or trigger.)

D. Dry chemical - Used on Class B, C, and D fires

(NOTE: Operates usually by squeezing a handle, trigger or lever on class D fires.)

E. Foam - Used on Class A and B fires

(NOTE: Operates by turning the extinguisher upside down.)

F. Halon - Used on class B and C fires

(NOTE: Operate by squeezing lever and holding upright.)

XIV. Types of fire extinguishers and their recommended operations

(NOTE: Always follow specific instructions on the fire extinguisher.)

A. Foam - Instead of spraying steam into the burning liquid, allow foam to fall lightly on the fire (Figure 9)

FIGURE 9

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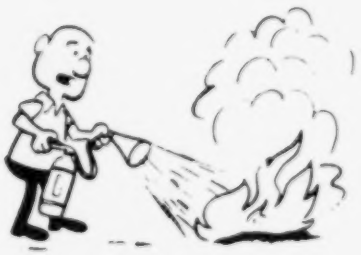
B. Carbon dioxide - Directly discharge as close to fire as possible, first at the edge of flames, then gradually forward and upward (Figure 10)

FIGURE 10



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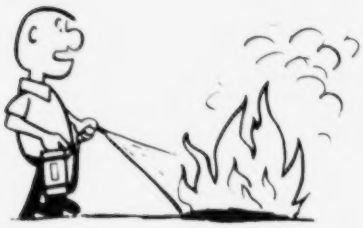
C. **Soda acid - Direct stream at base of fire (Figure 11)**

FIGURE 11



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D. **Stored pressure or water pump tank - place foot on foot pump and direct stream at base of fire (Figure 12)**

FIGURE 12

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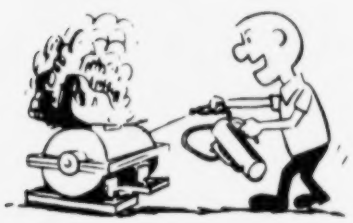
E. **Dry chemical - Direct at the base of the flames and with a Class A fire, follow up by directing the dry chemicals at remaining material that is burning (Figure 13)**

FIGURE 13



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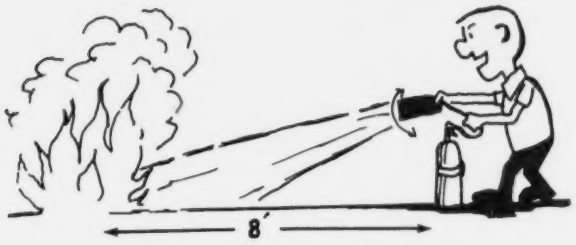
F. Halon - Start 8 feet from fire; direct at base of flames and sweep from side to side

FIGURE 14



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XV. Fire safety rules

A. Report immediately anything that might indicate a potential fire

EXAMPLES: The sound of wires shorting, a light that blinks, or the smell of smoke even when a flame is not visible

B. Know the location and proper operation of fire extinguishers and make sure they have been recently checked

C. Know where the nearest telephone is and make sure the telephone number of the nearest fire department is listed on the phone

D. Know the procedure for evacuating the building and the location of all fire exits in case one or more exits may be blocked

E. Smoke only at authorized times and in authorized areas; make sure cigarette butts are completely extinguished and properly discarded

F. Examine materials and equipment around the workplace to determine the types of fires that might occur; make sure available fire extinguishers are correct for the classes of fires that might occur

G. Isolate combustible materials in fire-resistant areas

H. Dispose of rubbish regularly

I. Conduct fire drills at regular intervals to make sure the alarm can be heard over shop noises and that everyone knows evacuation routes, exits and assembly points

(NOTE: During a fire alarm, students should go to an assembly point that is predetermined by the instructor; this point should be used to account for all students who have evacuated the building.)

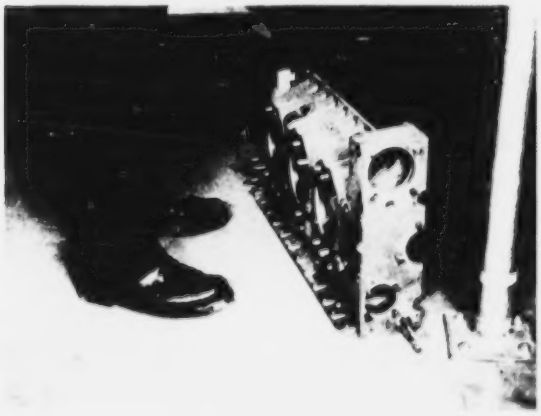
XVI. Steps in lifting heavy objects safely

A. Approach the load, evaluate its weight, size, and shape and consider your physical ability to handle it (Figure 15)

FIGURE 15

B. Place your feet close to the object to be lifted and keep your feet 8 - 12 inches apart for good balance (Figure 16)

FIGURE 16



C. Bend your knees to the degree that it is comfortable, get a good hold with your hands, then use both leg and back muscles to begin the lift (Figure 17)

FIGURE 17

D. Lift the load straight up, smoothly and evenly, while you push with your legs and keep the load as close as possible to your body (Figure 18)

FIGURE 18

E. Lift the load into carrying position, making no turning or twisting movements until the lift is completed (Figure 19)

FIGURE 19

F. Turn your body with changes of foot position while you visually check your path of travel to make sure it is clear

G. Set the load down by using leg and back muscles together, slowly lower the load by bending your knees, and release your grip only after the load is securely positioned (Figure 20)

FIGURE 20

H. When lifting or carrying with another worker, make sure the load is equally distributed, and carry long objects at the same level and on the same side of the body (Figure 21)

(NOTE: When moving or carrying large metal sheets, it is especially important to have another worker help.)

FIGURE 21

XVII. Steps to follow in case of an accident

A. Report all accidents and injuries to the instructor no matter how minor they may seem

B. Administer first aid if needed

(CAUTION: Administer first aid only if authorized and qualified.)

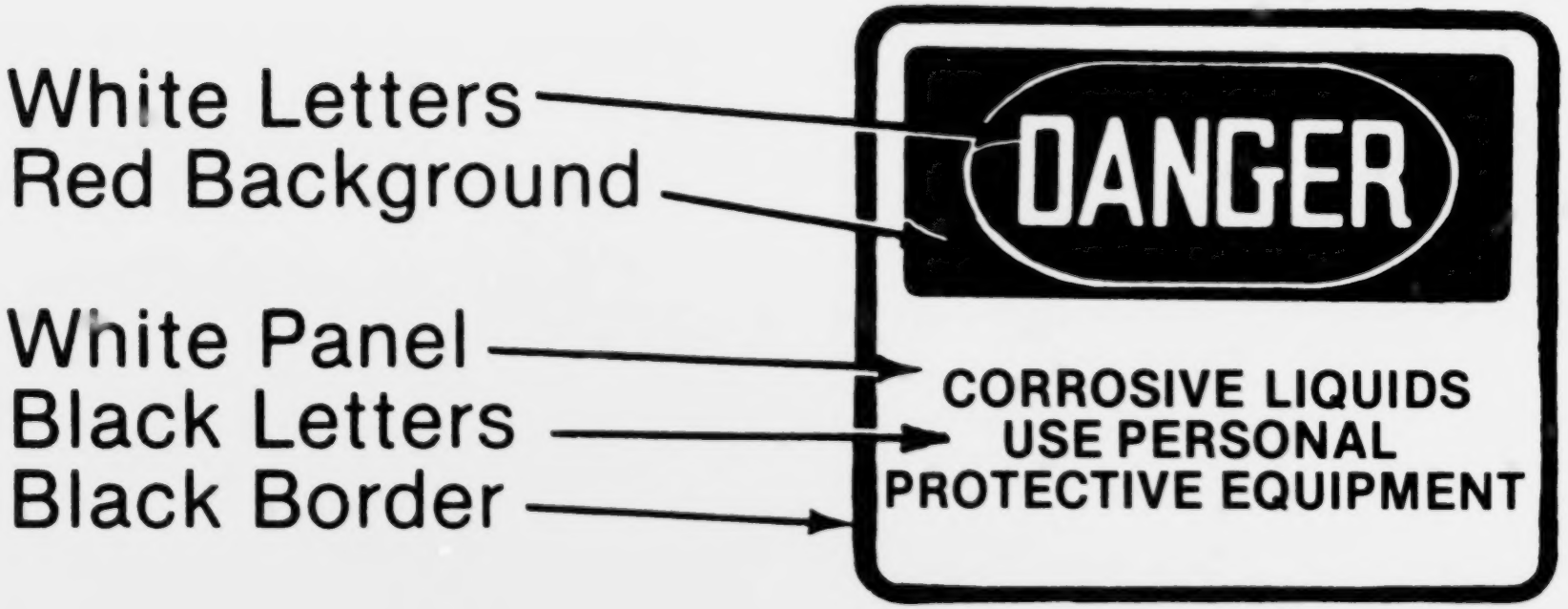
C. Take injured student to school nurse

D. School nurse will notify injured student's parent or guardian if student needs to see a physician

E. Instructor will fill out an accident report form.

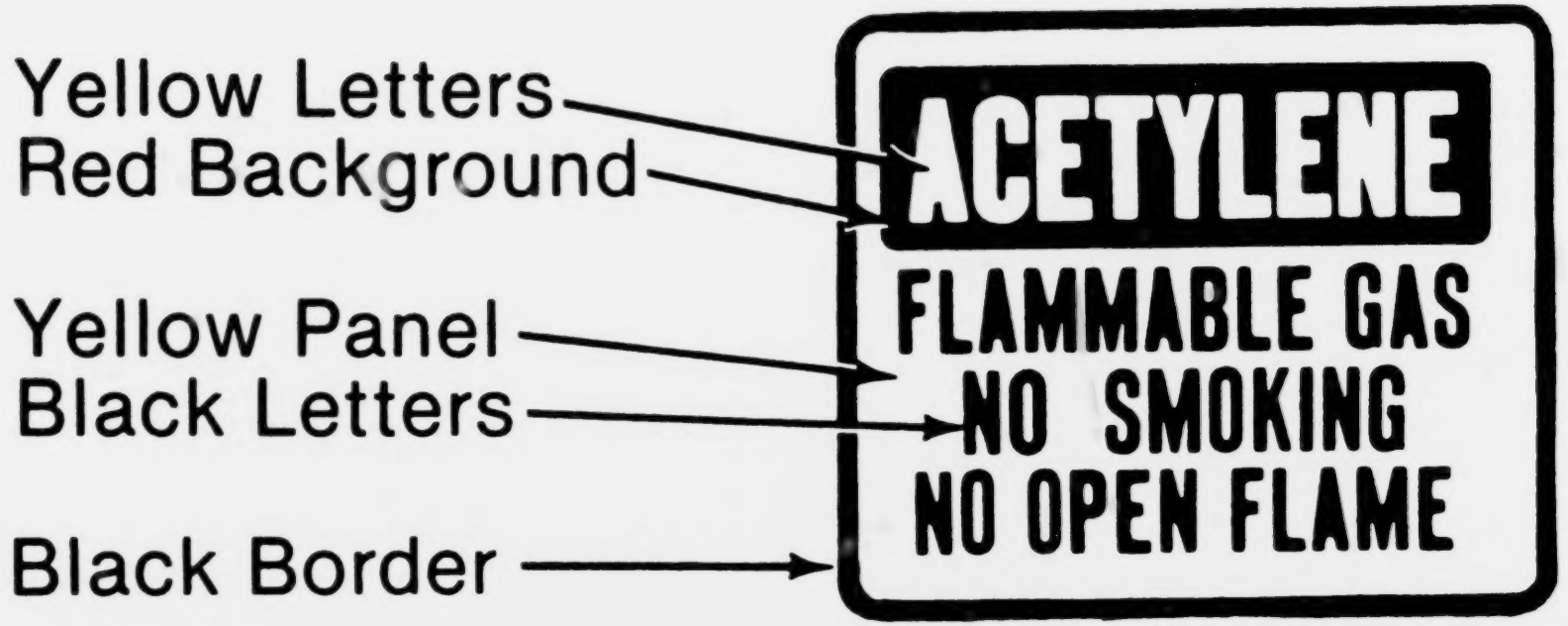
F. Investigate to determine the cause of the accident and ways to prevent the same accident from occurring again

Danger Signs



S101A-33

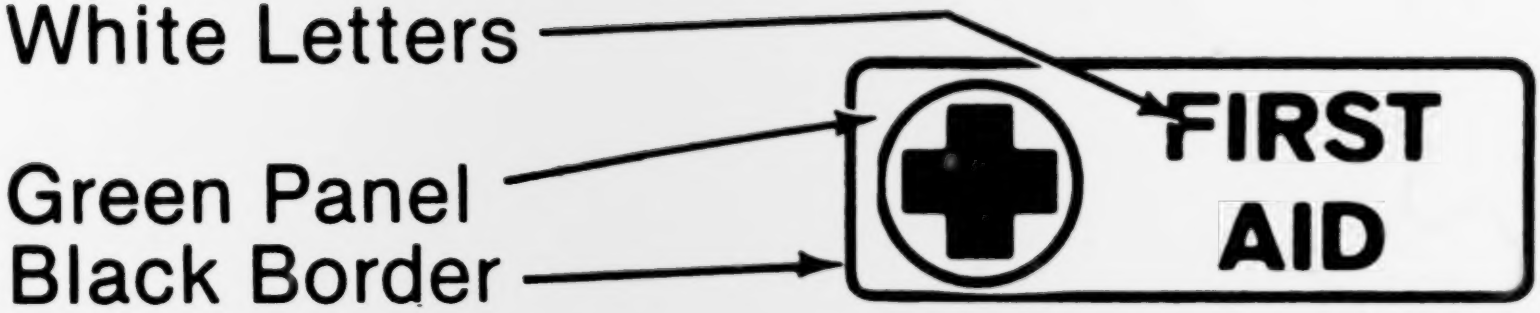
Caution Signs



S101A-35

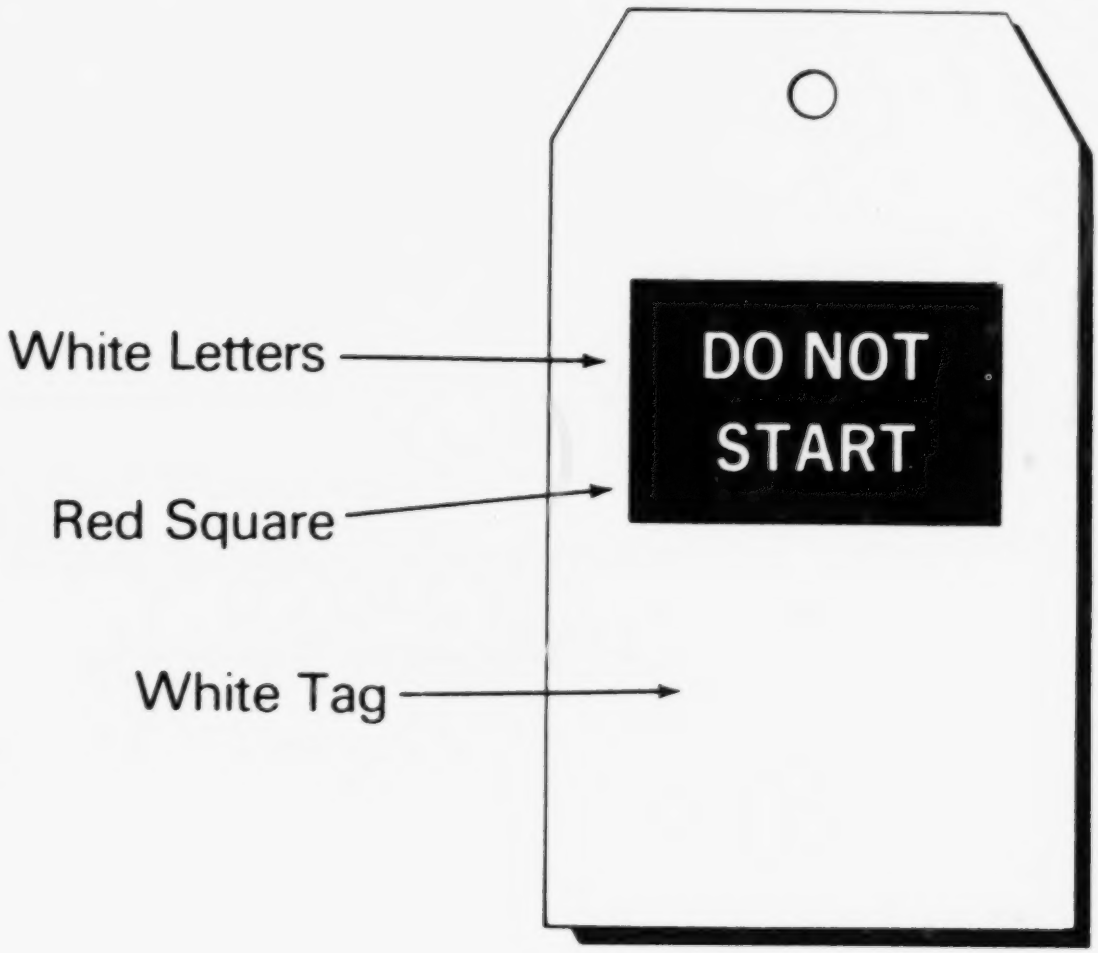
TM #2

Safety Instruction Signs

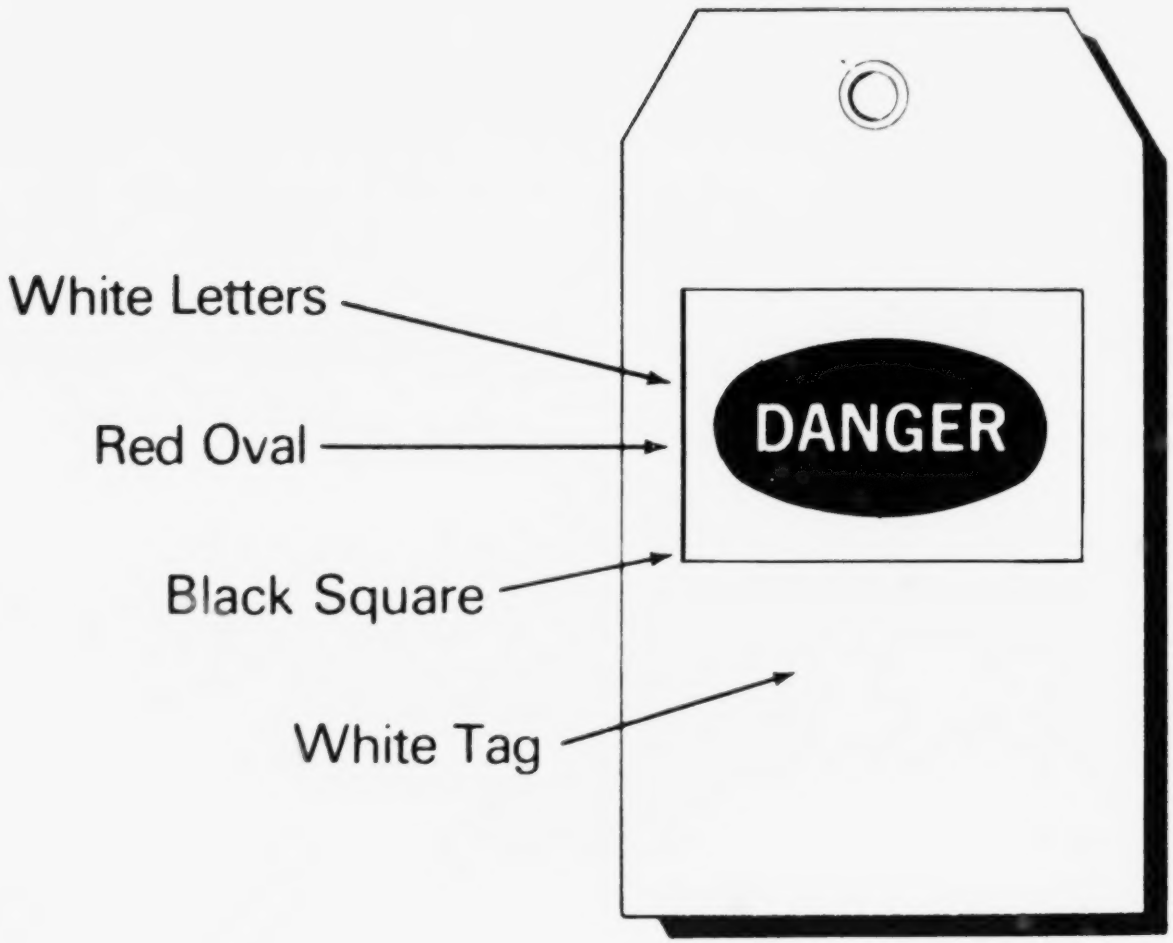


S101A-37

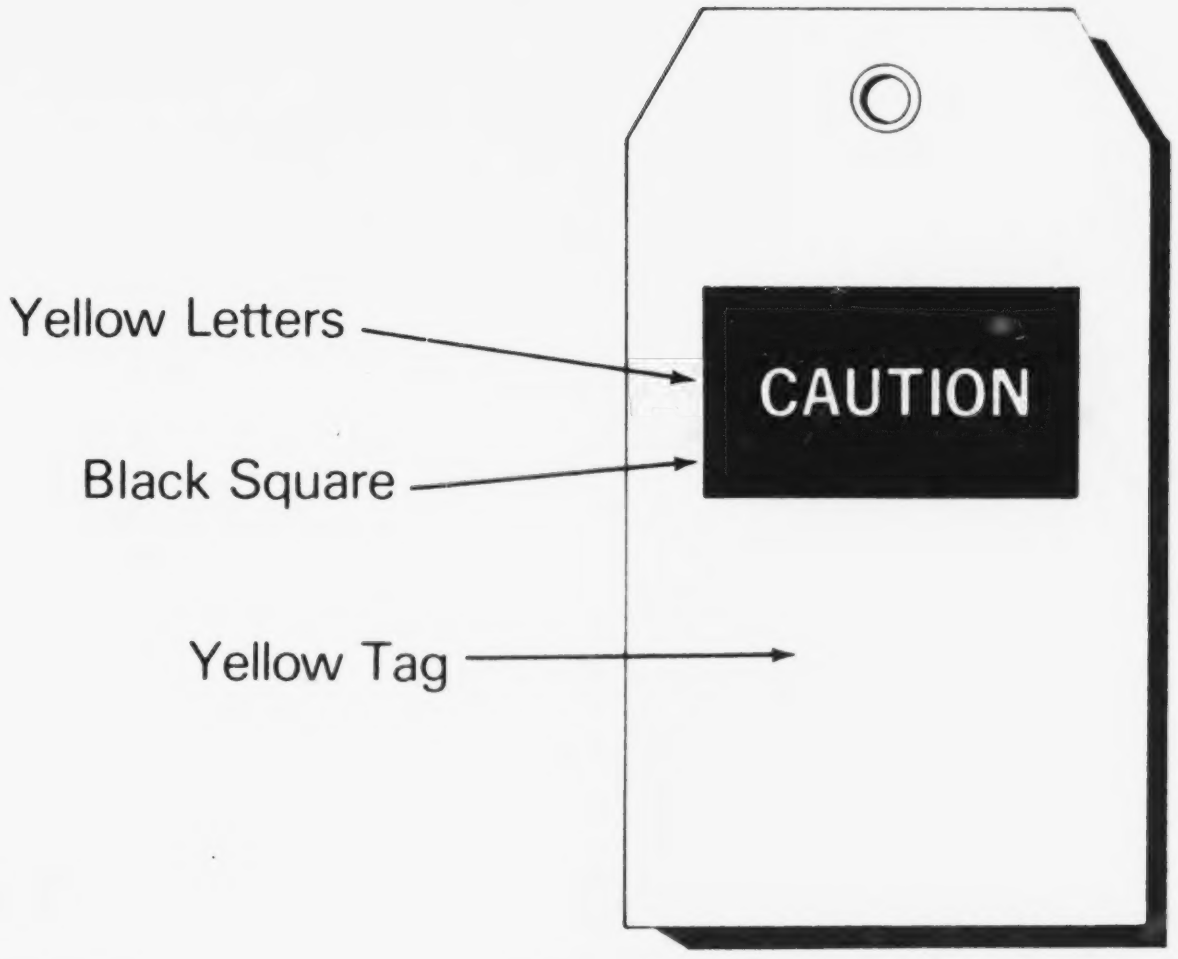
Accident Prevention Tags



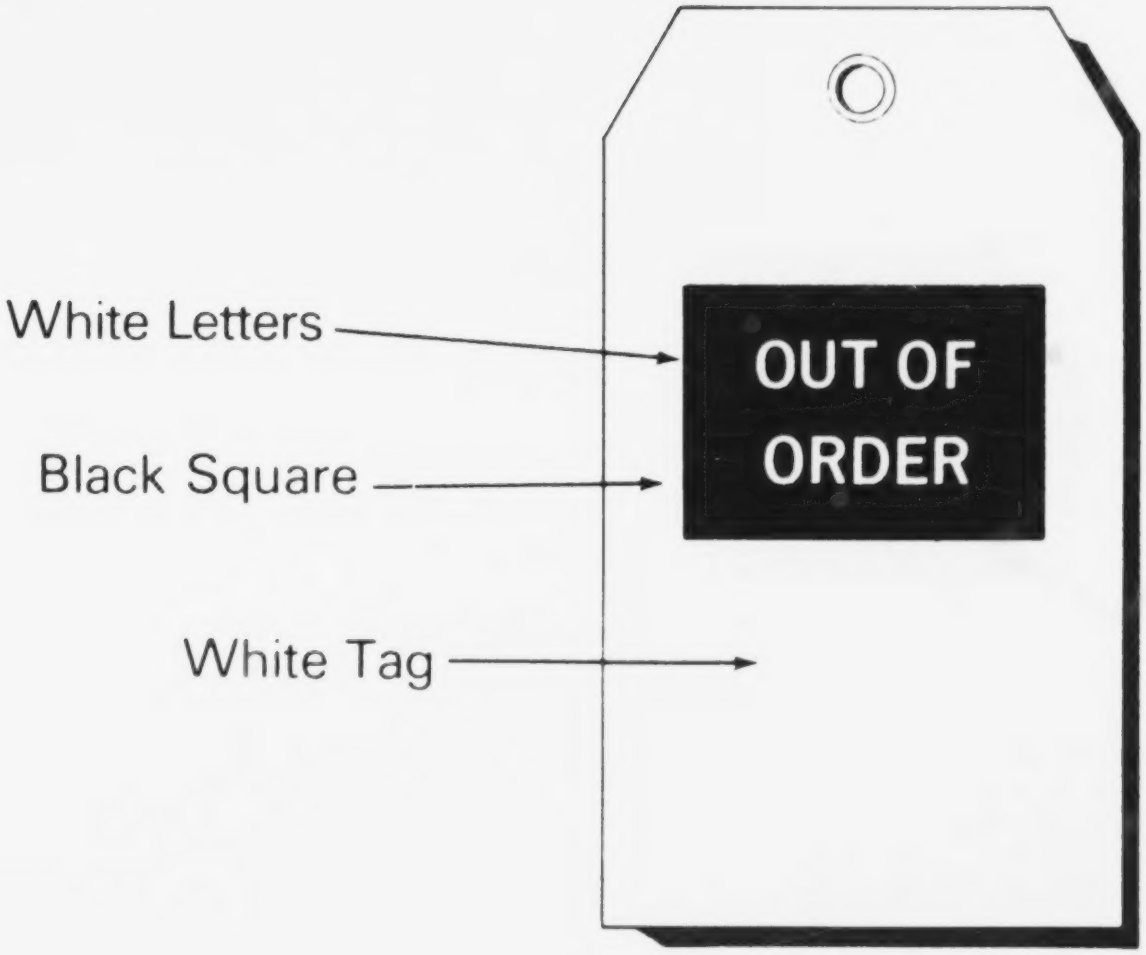
Danger Tags



Caution Tags



Out-of-Order Tags



TM #7

S101A-45

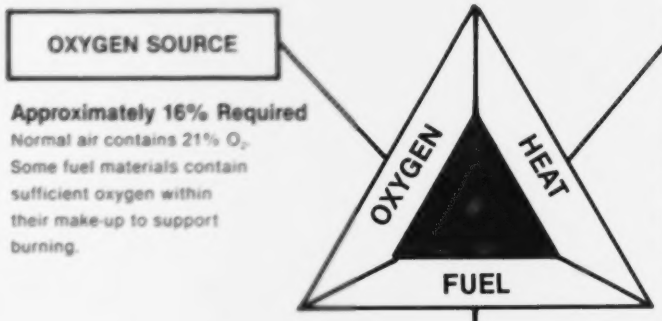
Classes of Fires

Adapted with permission of the National Fire Protection Association.

TM #8

S101A-47

Fire Triangle



OXYGEN SOURCE

Approximately 16% Required
Normal air contains 21% O_2.
Some fuel materials contain sufficient oxygen within their make-up to support burning.

HEAT SOURCES

To Reach Ignition Temperature
Open Flame — The Sun
Hot Surfaces
Sparks and Arcs
Friction — Chemical Action
Electrical Energy
Compression of Gases

PHYSICAL STATE

GASES

Natural Gas
Propane
Butane
Hydrogen
Acetylene
Carbon Monoxide
Others

LIQUIDS

Gasoline
Kerosene
Turpentine
Alcohol
Cod Liver Oil
Paint
Varnish
Lacquer
Olive Oil
Others

SOLIDS

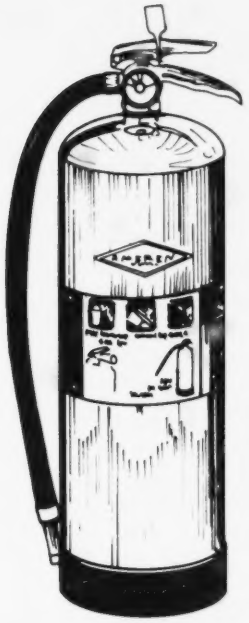
Bulky — Finely Divided — Dust

Coal	Plastic
Wood	Sugar
Paper	Grain
Cloth	Hay
Wax	Cork
Grease	*Others*
Leather	

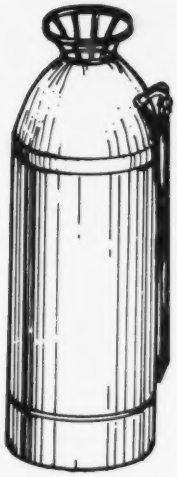
Used with permission of the Board of Regents, Oklahoma State University, Stillwater, Oklahoma, from *Essentials of Fire Fighting*, 2nd edition, Gene P. Carlson and William J. Vandevort, eds., 1983.

TM #9

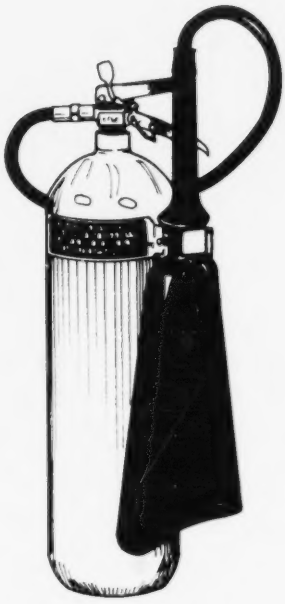
Types of Fire Extinguishers



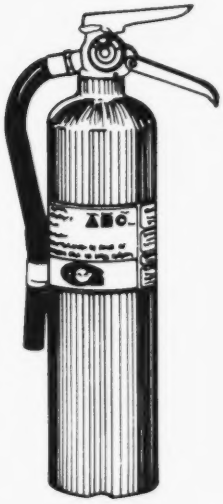
Pressurized Water



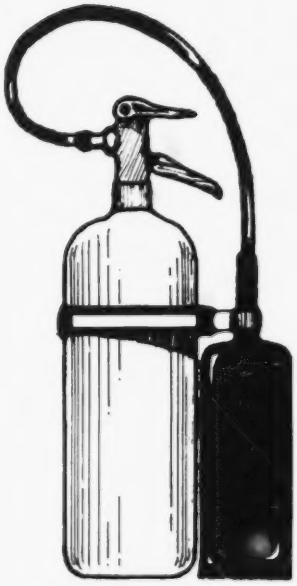
Soda-Acid



Carbon Dioxide



Dry Chemical

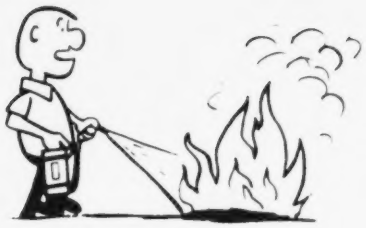


Halon

Foam

TM #10

Fire Extinguisher Operations



Soda

Direct stream at base of fire.

Foam

Allow foam to fall lightly on the fire.

Pump Tank

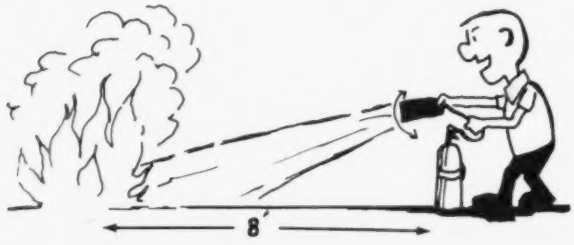
Place foot on foot pump and direct stream at base of fire.

Carbon Dioxide

Direct discharge as close to fire as possible, first at edge of flames, then gradually forward and upward.

Dry Chemical

Direct at base of flames. On Class A fire, follow up by directing dry chemicals at remaining burning material.



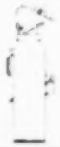
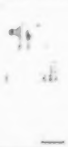
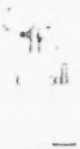
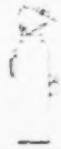
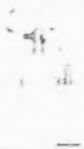
Halon

Start 8 feet from fire; direct at base of flames and sweep from side to side.

TM #11

Adapted with permission of the Distributive Education Materials Laboratory, Columbus, Ohio 43210.

Types of Fire Extinguishers

KIND OF FIRE		APPROVED TYPE OF EXTINGUISHER					
		MATCH UP PROPER EXTINGUISHER WITH CLASS OF FIRE SHOWN AT LEFT Important: Using the wrong type extinguisher for the fire may be dangerous					
DECIDE THE CLASS OF FIRE YOU ARE FIGHTING. . .	THEN CHECK THE COLUMNS TO THE RIGHT OF THAT CLASS	CARBON DIOXIDE Carbon Dioxide Gas Under Pressure	PUMP TANK Plain Water	MULTI-PURPOSE DRY CHEMICAL	ORDINARY DRY CHEMICAL	HALON	DRY POWDER
CLASS A FIRES Use These Extinguishers ORDINARY COMBUSTIBLES ●Wood ●Paper ●Cloth, etc.							
CLASS B FIRES Use These Extinguishers FLAMMABLE LIQUIDS, GREASE ●Gasoline ●Paints ●Oils, etc.							
CLASS C FIRES Use These Extinguishers ELECTRICAL EQUIPMENT ●Motors ●Switches, etc.							
CLASS D FIRES Use This Extinguisher COMBUSTIBLE METALS ●Iron ●Magnesium							

Adapted with permission of American Association for Vocational Instructional Materials, Athens, Georgia, from *Developing Shop Safety Skills* by Clinton O. Jacobs and J. Howard Turner, 1981.

S101A-55

TM #12

SAFETY
S101 GENERAL HANGAR AND SHOP SAFETY
INDENTIFY HANGAR AND SHOP SAFETY HAZARDS
S101-A

WORKBOOK SUPPLEMENT #1 - Complete a Student Safety Pledge

_____ _____ _____, who is enrolled in Vocational

_____, will as part of his or her shop experience, operate machines,

providing that the parent or guardian gives written permission.

It is understood that each student will be given proper instruction, both in the use of the equipment and in correct safety procedures concerning it, before being allowed to operate it alone. The student must assume responsibility for following safe practices, and we therefore ask that he or she subscribe to the following safety pledge.

1. I promise to follow all safety rules for the shop.

2. I promise never to use a machine without first having permission from the instructor.

3. I will not ask permission to use a particular machine unless I have been instructed in its use, and have made 100 percent on the safety test for that machine.

4. I will report any accident or injury to the teacher immediately.

Date _____ Student's signature _____

I hereby give my consent to allow my child to operate all machines and equipment necessary in carrying out the requirements of the course in which he or she is enrolled.

Date _____ Parent's signature _____

Parents are cordially invited to visit the shop to inspect the machines and to see them in operation.

SAFETY
S101 GENERAL HANGAR AND SHOP SAFETY
IDENTIFY HANGAR AND SHOP SAFETY HAZARDS
S101-A

WORKBOOK SUPPLEMENT #2 - Complete a Hangar and Shop Safety Check

It is essential that you develop safe work habits by becoming more aware of unsafe conditions that may exist in your hangar or shop area. If you are able to recognize an unsafe situation you should be able to take the necessary precautions to avoid personal injury to either yourself of another student. Use this workbook supplement to check your hangar and shop areas for safety hazards. Check your hangar and shop for the items listed and place an "X" in either the "yes" or "no" column.

ITEM	YES	NO
Tools sharp and clean		
Tools properly stored		
Hangar and shop floors clean		
Emergency evacuation plans posted		
Fire extinguishers easily accessible		
Metal waste containers for oily shop towels and oily waste available		
Safety zones marked		
Lighting and ventilation are adequate		
Electrical circuits not overloaded		
Electrical cords in good repair		
Flammable liquids stored in safety-type containers		
All power tools grounded		
First-aid kits available		
Machinery and equipment arranged to permit safe work practices and ease in cleaning		

WORKBOOK SUPPLEMENT #2

ITEM	YES	NO
Combustible materials disposed of properly and stored in approved containers		
Materials stored in such a way that they will not be tripping hazards		
Accident prevention signs used properly		
Sufficient brooms, brushes, and other housekeeping equipment available		
Washing facilities available and accessible to areas where chemicals are used		
Work areas and benches clear and free of debris and other hazards		

WORKBOOK SUPPLEMENT #3 - Discuss Steps to be Followed in Case of an Accident

Given the accident below, discuss the steps to be followed and state the safety rules that would have prevented the accident from occurring.

A student is cleaning metal chips from a drill press with compressed air; one of the chips punctures the eye of a classmate.

a. Steps to be followed - _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

b. Safety rules that would have prevented the accident - _____

_____

_____

_____

_____

_____

_____

_____

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_____

_____

SAFETY
S101 GENERAL HANGAR AND SHOP SAFETY
IDENTIFY HANGAR AND SHOP SAFETY HAZARDS
S101-A

WORKBOOK SUPPLEMENT #4 - Complete an Accident Report Form

When an accident occurs in an industry or school situation, the supervisor, a witness to the accident, and/or the injured person may be required to complete an accident report form. Using the following situation, complete the accident report form on the next page.

On January 22, 1985, at 10:20 A.M., Jerri G. Jones was cutting a piece of metal using a bandsaw. A classmate, Shawn T. Smith, approached Jerri to talk about the previous night's VICA party. As Shawn approached, Jerri turned slightly. The distraction caused Jerri to run her hand into the saw. The instructor, John Hughes, immediately turned off the saw, administered emergency first aid and sent another student for the school nurse. At 10:25 A.M., Sarah Crawford, the school nurse, telephoned an ambulance and Jerri's father, Craig Jones. Jerri was taken to Memorial Hospital. As a results of the minor distraction, Jerri permanently lost two fingers.

Jerri is a 17-year-old senior at Lincoln High School.
Her home address is 216 S. Walnut, Lincoln, Oklahoma.

There were two witnesses to the accident:
Sarah James 4275 S. Boulevard, Lincoln, Oklahoma
Mark Payne 1922 S. Washita, Lincoln, Oklahoma

There were no safety zones marked or accident prevention signs posted in the shop.

STUDENT ACCIDENT REPORT FORM

1. Name _____ Home Address _____
2. Home School _____ Sex M ☐ F ☐ Age _____ Grade _____
3. Time accident occurred: hour _____ A.M. _____ P.M. _____ Date _____
4. Place of accident _____
5. Teacher in charge _____
   Present at scene of accident yes ☐ no ☐ _____
6. Description of accident (Specify any tools, machinery, or equipment involved.) _____

_____

_____

_____

_____

7. Nature and location of injury (Describe fully.) _____

_____

_____

_____

8. Degree of injury: Nondisability ☐ Temporary disability ☐
   Permanent impairment ☐ Death ☐
   Total number of days lost from school: _____ (To be filled in when student returns.)
9. Immediate action taken _____

_____

_____

   First aid ☐ Name _____
   Sent home ☐ Name _____
   Sent to Physician ☐ Name _____
   Sent to Hospital ☐ Name _____
10. Parent or other individual notified _____
    When _____ How _____ By whom _____
11. Witnesses 1. Name _____ Address _____
    2. Name _____ Address _____
12. Follow-up _____

_____

_____

13. Remarks (List any specific unsafe acts and unsafe conditions existing.) _____

_____

_____

14. Recommendations for prevention _____

_____

_____

Signed: Principal _____ Teacher _____
Nurse _____ Student _____

SAFETY
S101 GENERAL HANGAR AND SHOP SAFETY
IDENTIFY HANGAR AND SHOP SAFETY HAZARDS
S101-A

ANSWERS TO WORKBOOK SUPPLEMENTS

Workbook Supplement #1 - Evaluated to the satisfaction of the instructor

Workbook Supplement #2 - Evaluated to the satisfaction of the instructor

Workbook Supplement #3

a. Steps to be followed

1. Report the accident to the instructor

2. Administer first aid

(NOTE: Administer first aid only if authorized and qualified.)

3. Take injured student to the school nurse

4. School nurse will notify student's parent or guardian

5. Instructor will fill out accident report form

6. Investigate to determine the cause of the accident and ways to prevent the same accident from occurring again

b. Safety rules that would have prevented the accident

1. Do not clean chips from a machine using compressed air

2. Wear safety glasses or goggles

Workbook Supplement #4

STUDENT ACCIDENT REPORT FORM

1. Name JERRI G. JONES Home Address 216 S. WALNUT LINCOLN, OK
2. Home School LINCOLN HIGH SCHOOL Sex M ☐ F ☒ Age 17 Grade 12
3. Time accident occurred: hour 10:20 A.M. X P.M. ____ Date JANUARY 22, 1985
4. Place of accident SCHOOL SHOP
5. Teacher in charge JOHN HUGHES
   Present at scene of accident yes ☒ no ☐
6. Description of accident (Specify any tools, machinery, or equipment involved.)
   JERRI WAS DISTRACTED BY SHAWN SMITH; AMPUTATED TWO FINGERS WITH BANDSAW
7. Nature and location of injury (Describe fully.) AMPUTATED TWO FINGERS
8. Degree of injury: Nondisability ☐ Temporary disability ☐
   Permanent impairment ☒ Death ☐
   Total number of days lost from school: _____ (To be filled in when student returns.)
9. Immediate action taken INSTRUCTOR IMMEDIATELY TURNED OFF THE MACHINE, ADMINISTERED EMERGENCY FIRST AID, CALLED SCHOOL NURSE
   First aid ☒ Name JOHN HUGHES
   Sent home ☐ Name
   Sent to Physician ☐ Name
   Sent to Hospital ☒ Name MEMORIAL HOSPITAL
10. Parent or other individual notified FATHER - CRAIG JONES
    When 10:25 A.M. How TELEPHONE By whom SARAH CRAWFORD
11. Witnesses 1. Name SARAH JAMES Address 4275 S. BOULEVARD, LINCOLN, OK
    2. Name MARK PAYNE Address 822 S. WASHITA, LINCOLN, OK
12. Follow-up
13. Remarks (List any specific unsafe acts and unsafe conditions existing.) JERRI WAS DISRUPTED BY SHAWN SMITH WHILE WORKING AT THE BANDSAW
14. Recommendations for prevention CLASS DISCUSSION ON THE IMPORTANCE OF NOT DISTRACTING STUDENTS WHEN WORKING ON MACHINES. CHECK TO MAKE SURE ACCIDENT PREVENTION SIGNS ARE POSTED AND SAFETY ZONES ARE MARKED.

Signed: Principal _____ Teacher _____
Nurse _____ Student _____

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SAFETY
S101 GENERAL HANGAR AND SHOP SAFETY
IDENTIFY HANGAR AND SHOP SAFETY HAZARDS
S101-A

THEORY TEST

1. Match terms associated with general hangar and shop safety to their correct definitions. Write the correct numbers in the blanks.

_____a.	Any suddenly occurring, unintentional event which causes injury or property damage	1. Safety
_____b.	Potential source of damage	2. Accident
_____c.	State or condition of being safe; freedom from danger, risk or injury	3. Hazard

2. List the three basic safety objectives.

a. _____

b. _____

c. _____

3. Select proper safety attitudes by writing an "X" in the blanks before the correct statements.

_____a. Report only major accidents

_____b. Have proper training in how to use equipment and tools before using them

_____c. Obey all safety rules

_____d. Understand all safety rules

_____e. Always be alert for unsafe practices, tools, and conditions

_____f. Make safety a constant concern

4. Select general safety precautions by writing an "X" in the blanks before the correct statements.

_____a. Retain all guards and safety devices only when necessary

_____b. Use compressed air to clean chips from a machine

_____c. Operate equipment only after receiving proper operating instructions

_____d. Do not use any defective tools, machines or equipment

_____e. Operate a machine together when working in pairs

_____f. Make minor electrical repairs to machines or tools

_____g. Record all accidents in writing

_____h. Keep shop floors clean of scraps and litter

_____i. Disconnect power from machine tools before performing maintenance tasks such as oiling and cleaning

_____j. Turn off power and wait for equipment or machine to completely stop before leaving a machine or equipment

5. Complete statements concerning how safety is affected by organization, equipment and maintenance. Write the correct word in each blank.

a. Stairways shall be kept _____ and well _____.

b. All power and hand tools shall be kept _____ and in _____ working condition.

c. Brightly colored _____ _____ shall be painted around _____ tools.

d. Floors shall _____ be swept clean.

e. Adequate _____, _____ and _____ removal shall be provided. Fume and _____ removal shall also be provided.

f. Dangerous materials shall be stored in _____ cabinets.

g. All power tools, whether portable or fixed, shall be _____.

h. Electrical circuits shall not be _____.

i. _____ liquids shall be stored in safety-type containers and only _____ amounts shall be kept on hand.

j. Fire extinguishers of the proper types shall be located in _____ places but not in likely _____ areas.

6. List ten causes of accidents.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

h. _____

i. _____

j. _____

7. List steps in maintaining a clean and orderly shop.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

h. _____

i. _____

j. _____

k. _____

8. Complete statements concerning hangar safety. Write the correct answers in the blanks.

   a. Be aware of _____ and _____ materials spills.

   b. Do not move aircraft _____.

   c. Be alert of any _____ movement.

   d. Do not move an aircraft without _____ _____.

   e. _____ smoke in the hangar area.

   f. Position _____ _____ correctly.

9. Match the colors of the safety color code to their correct applications. Write the correct numbers in the blanks. Some blanks may have more than one correct answer.

_____a.	Caution and physical hazards	1.	Federal safety green
_____b.	Location of firefighting equipment	2.	Federal safety white
_____c.	Location of first-aid equipment	3.	Federal safety orange
_____d.	Dangerous parts of machines	4.	Federal safety purple
_____e.	Housekeeping purposes	5.	Federal safety black
_____f.	Traffic flow	6.	Federal safety red
_____g.	Radiation hazards	7.	Federal safety yellow

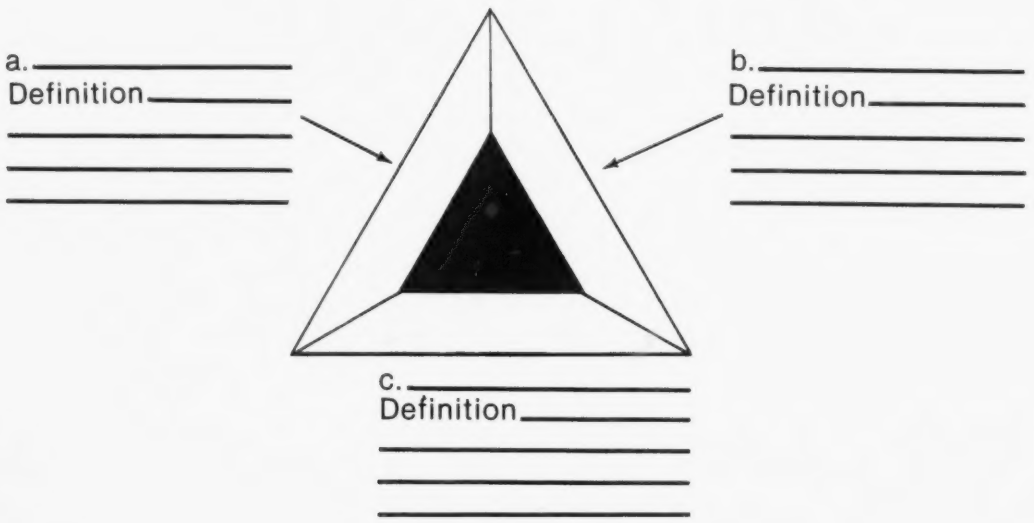
10. Match accident prevention signs and tags to their colors and uses. Write the correct numbers in the blanks.

_____a.	Used where an immediate hazard exists; colors are red, black, and white	1. Caution signs
_____b.	Used to warn against potential hazards or to caution against unsafe practices; colors are yellow and black	2. Danger signs
_____c.	Used where there is a need for general instructions and suggestions relative to safety measures; colors are white, green, and black	3. Safety instruction signs
_____d.	Are placed at the starting mechanism which would cause hazardous conditions should the equipment be energized; colors are red and white or gray	4. Caution tags
_____e.	Are placed only where an immediate hazard exists; colors are red, black, and white	5. Out-of-order tags
_____f.	Are used to warn against potential hazards or to caution against unsafe practices; colors are yellow and black	6. Danger tags
_____g.	Are used to identify pieces of equipment that are out of order; colors are blue and white	7. Do-not-start tags

11. Match classes of fires to their correct descriptions. Write the correct numbers in the blanks.

_____a.	Fires that occur with flammable liquids	1. Class A
_____b.	Fires that occur in ordinary combustible materials	2. Class B
_____c.	Fires that occur in or near electrical equipment	3. Class C
_____d.	Fires that occur with combustible metals	4. Class D

12. Label and explain components of the fire triangle.



13. Match types of fire extinguishers to the classes of fires on which they are used. Write the correct numbers in the blanks. Some blanks may have more than one correct answer.

____a. Class B	1. Water pump tank
____b. Class C	2. Carbon dioxide (CO_2)
____c. Class A	3. Dry chemical
____d. Class D	4. Soda acid
	5. Foam
	6. Halon

14. Match types of fire extinguishers with their recommended operations. Write the correct numbers in the blanks.

_____a.	Instead of spraying stream into the burning liquid, allow foam to fall lightly on the fire	1. Carbon dioxide (CO_2)
_____b.	Directly discharge as close to the fire as possible, first at the edge of flames, then gradually forward and upward	2. Stored pressure or water pump tank
_____c.	Direct stream at base of fire	3. Dry chemical
_____d.	Place foot on foot pump and direct stream at base of fire	4. Foam
_____e.	Direct at the base of the flames and with a class A fire, follow up by directing at remaining burning material	5. Soda acid
_____f.	Start 8 feet from fire; direct at base of flames an sweep from side to side	6. Halon

15. Select fire safety rules. Write an "X" in the blanks before the correct statements.

_____a. Report immediately anything that might indicate a potential fire hazard

_____b. Know the location and the proper operation of fire extinguishers and make sure they have been recently checked

_____c. Know the location of the nearest telephone; make sure the number of the nearest fire department is listed on the phone

_____d. Know the procedure for evacuating the building and the location of all fire exits in case one or more exits are blocked

_____e. Smoke only at authorized times and in authorized areas; make sure cigarette butts are completely extinguished and properly discarded

_____f. Examine materials and equipment around the workplace to determine the types of fires that might occur; make sure available fire extinguishers are correct for the classes of fires that might occur

_____g. Isolate combustible materials in fire-resistant areas

_____h. Dispose of rubbish at least once a month

_____i. Conduct fire drills at regular intervals to make sure the alarm can be heard over shop noises and that everyone knows evacuation routes, exits and assembly points

16. Arrange in order steps in lifting heavy objects. Write numbers in the blanks to indicate the correct order of the steps in sequence.

____a. Approach the load, evaluate its weight, size, and shape and consider your physical ability to handle it

____b. Place your feet close to the object to be lifted and keep your feet 8 to 12 inches apart for good balance

____c. Set the load down by using leg and back muscles together, slowly lower the load by bending your knees, and release your grip only after the load is securely positioned

____d. Lift the load into carrying position, making no turning or twisting movements until the lift is completed

____e. Bend your knees to the degree that it is comfortable, get a good hold with your hands, then use both leg and back muscles to begin the lift

____f. When lifting or carrying with another worker, make sure the load is equally distributed, and carry long objects at the same level and on the same side of the body

____g. Turn your body with changes of foot position while you visually check your path of travel to make sure it is clear

____h. Lift the load straight up, smoothly and evenly, while you push with your legs and keep the load as close as possible to your body

17. Select proper steps to follow in case of an accident. Write an "X" in the blanks before the correct statements.

____a. Investigate to determine the cause of the accident and ways to prevent the same accident from occurring again

____b. Apply a tourniquet

____c. School nurse will notify student's parent or guardian if the student needs to see a physician

____d. Administer first aid if needed

(CAUTION: Administer first aid only if authorized and qualified.)

____e. Administer mouth to mouth resuscitation in all cases

____f. Take injured student to school nurse

____g. Student will be required to sign an insurance release form before seeing the school nurse

_____h. Report all accidents and injuries to the instructor no matter how minor they may seem

_____i. First, mop up blood to prevent a slick spot on the floor

_____j. Instructor will fill out an accident report form

(NOTE: Test questions 18-21 are workbook supplements. They are an important part of this test. If they have not been completed, check with your instructor.)

18. Complete a student safety pledge.

19. Complete a hazard check of the hangar and shop area.

20. Discuss steps to be followed in case of an accident.

21. Complete an accident report.

SAFETY
S101 GENERAL HANGAR AND SHOP SAFETY
IDENTIFY HANGAR AND SHOP SAFETY HAZARDS
S101-A

ANSWERS TO THEORY TEST

1. a. 2
   b. 3
   c. 1

2. a. Know safety precautions
   b. Develop a safety concept
   c. Practice safety

3. b, c, d, e, f

4. c, d, g, h, i, j

5. a. Clear; lighted
   b. Sharp; good
   c. Safety zones; power
   d. Frequently
   e. Lighting, ventilation, dust; vapor
   f. Metal
   g. Grounded
   h. Overloaded
   i. Flammable; limited
   j. Convenient; fire

6. Any ten of the following

   a. Unnecessary risk-taking
   b. Rushed or hurried work
   c. Showing off
   d. Lack of information
   e. Preoccupation of mind
   f. Distraction of attention
   g. Fear
   h. Experimentation
   i. Failure to follow instructions
   j. Poor discipline
   k. Defective machinery
   l. Improperly guarded machinery
   m. Faulty layout
   n. Faulty installation
   o. Defective materials or equipment
   p. Excitement
   q. Selfishness
   r. Improper clothing
   s. Poor health
   t. Unsafe machinery conditions
   u. Unsafe human actions
   v. Acts of nature

7. a. Arrange machinery and equipment to permit safe, efficient work practices and ease in cleaning

   b. Store materials and supplies in proper places

   c. Store tools and accessories safely in cabinets, on racks, or other suitable devices

   d. Keep work areas and work benches clear and free of debris and other hazards

   e. Keep floors clean and free from obstructions and slippery substances

   f. Keep aisles, traffic areas, and exits free of materials and debris

   g. Dispose of combustible materials properly or store in approved containers

   h. Store oily towels in approved metal containers

   i. Make sure that students working in the area know proper procedures to follow in keeping the area clean and orderly

   j. Make available sufficient brooms, brushes, and housekeeping equipment

   k. Keep drinking fountain and washing facilities clean and neat at all times

8. a. Oil, flammable
   b. Propellers
   c. Aircraft
   d. Wing walkers
   e. Never
   f. Ladder stands

9. a. 7
   b. 6
   c. 1
   d. 3
   e. 2 and/or 5
   f. 2 and/or 5
   g. 4

10. a. 2
    b. 1
    c. 3
    d. 7
    e. 6
    f. 4
    g. 5

ANSWERS TO THEORY TEST

11. a. 2
    b. 1
    c. 3
    d. 4

12. a. Oxygen--Necessary to sustain combustion
    b. Heat--Enough to raise the fuel to its ignition temperature
    c. Fuel--Any combustible material

13. a. 2, 3, 5, 6
    b. 2, 3, 6
    c. 1, 4, 5
    d. 3

14. a. 4
    b. 1
    c. 5
    d. 2
    e. 3
    f. 6

15. a, b, c, d, e, f, g, i

16. a. 1
    b. 2
    c. 7
    d. 5
    e. 3
    f. 8
    g. 6
    h. 4

17. a, c, d, f, h, j

18. Evaluated to the satisfaction of the instructor

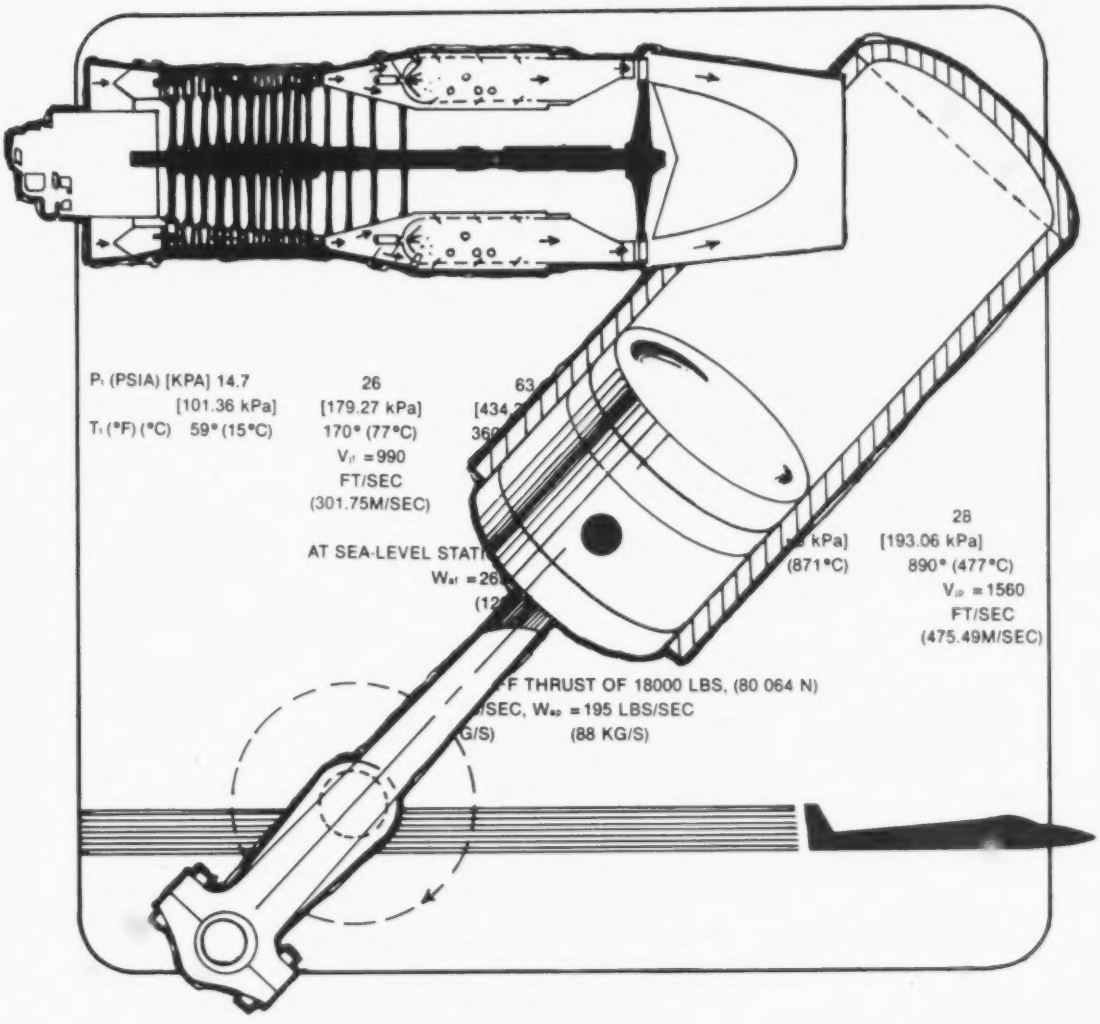
19. Evaluated to the satisfaction of the instructor

20. Evaluated to the satisfaction of the instructor

21. Evaluated to the satisfaction of the instructor

MODULE OF INSTRUCTION
FOR
AVIATION MAINTENANCE TECHNOLOGY

GENERAL
G101 MATHEMATICS AND PHYSICS
SOLVE PROBLEMS USING PRINCIPLES OF MATHEMATICS
G101-A



GENERAL
G101 MATHEMATICS AND PHYSICS
SOLVE PROBLEMS USING PRINCIPLES OF MATHEMATICS
G101-A

MODULE CONTENTS

A. Introduction and Module Objective

B. Specific Objectives

C. Instructor's Module Implementation Guide

1. Instructional Supplement #1--Math Problems

2. Answers to Instructional Supplement #1

D. Technical Information Supplement #1--Terms and Definitions

E. Theory Test

F. Answers to Theory Test

GENERAL
G101 MATHEMATICS AND PHYSICS
SOLVE PROBLEMS USING PRINCIPLES OF MATHEMATICS
G101-A

INTRODUCTION

In today's technological society, mathematics is a basic language. Even before the manufacturing process of an aircraft begins, millions of mathematical calculations have been made during the planning stages. As an aviation maintenance technician (aircraft mechanic), you will constantly be called upon to make many mathematical calculations before the maintenance process begins.

MODULE OBJECTIVE

After completion of this module, you will be able to add, subtract, multiply, and divide whole numbers, signed numbers, decimal and common fractions, and mixed numbers. You will also be able to multiply and divide by scientific notation, calculate percentages, ratios, proportions, powers and roots of numbers, area and volume of geometric shapes, and use conversion tables to convert units between the English and metric systems. You will demonstrate this knowledge by completing the procedures outlined in the workbook assignments and by scoring 85 percent on the module theory test.

GENERAL
G101 MATHEMATICS AND PHYSICS
SOLVE PROBLEMS USING PRINCIPLES OF MATHEMATICS
G101-A

SPECIFIC OBJECTIVES

After completion of this module, you will be able to

1.	Match terms related to principles of mathematics to their correct definitions. (1)	Technical Supplement #1
2.	Convert digits between the decimal and binary number systems. (1)	EA-ITP-G 1:II:2-3 EA-ITP-GW 1:I:1
3.	Add, subtract, multiply, and divide whole numbers. (3)	EA-ITP-G 1:III:4-6 EA-ITP-GW I:2-3
4.	Add, subtract, multiply, and divide decimal fractions. (3)	EA-ITP-G 1:IV:7-9 EA-ITP-GW I:4-6
5.	Multiply and divide by scientific notation. (2)	EA-ITP-G 1:V:10-11 EA-ITP-GW I:6-7
6.	Add, subtract, multiply, and divide common fractions. (3)	EA-ITP-GW 1:VI:12-14 EA-ITP-G 1:IX:17, XI:19 EA-ITP-GW I:7-8, I:10-11
7.	Add and subtract mixed numbers. (3)	EA-ITP-G 1:VII:15 EA-ITP-GW I:9
8.	Use conversion tables to convert numbers between common fractions and decimals. (3)	EA-ITP-G 1:XII:20 EA-ITP-G 1:XIII:21
9.	Add, subtract, multiply, and divide signed numbers. (3)	EA-ITP-G 1:XV:23 EA-ITP-GW I:12-13
10.	Convert decimal numbers to percentages. (3)	EA-ITP-G 1:XVI:24 EA-ITP-GW I:14
11.	Determine ratios. (3)	EA-ITP-G 1:XVII:25 EA-ITP-GW I:14-15
12.	Solve problems involving proportions. (3)	EA-ITP-G 1:XVIII:26 EA-ITP-GW I:14-15
13.	Extract roots and raise numbers to a given power. (1)	EA-ITP-G 1:XIX:27-29 EA-ITP-GW I:15
14.	Determine area and volume of various geometrical shapes. (3)	EA-ITP-G 1:XX:30-33 EA-ITP-G 1:XXI:34-35 EA-ITP-GW I:16-19

SPECIFIC OBJECTIVES

15. Identify the relationships for sine, cosine, and tangent. (1)	EA-ITP-G EA-ITP-GW	1:XXII:36-37 I:20
16. Use conversion tables to convert units between the English and the metric systems. (3)	EA-ITP-G EA-ITP-GW	1:XXIV:41-44 I:21

GENERAL
G101 MATHEMATICS AND PHYSICS
SOLVE PROBLEMS USING PRINCIPLES OF MATHEMATICS
G101-A

INSTRUCTOR'S MODULE IMPLEMENTATION GUIDE

I. Implementation Suggestions

Estimated Teaching Time		Theory	Lab
Objective 1	Explain why math is important in aviation. Discuss terms and definitions.		
Objectives 2-9	Discuss objectives 2-9 and work examples on the chalkboard. Have students complete EA-ITP-GW, Part I, pages 11-13. If students need additional practice, use Instructional Supplement #1.		
Objectives 10-14	Discuss objectives 10-14. Work examples on the chalkboard. Have students complete EA-ITP-GW, Part I, pages 14-19. If students need additional practice converting decimal numbers to percentages, use Instructional Supplement #1.		
Objective 15	Discuss the Pythagoreon Theorem and the relationship of trigonometric functions. Demonstrate the use of trigonometric tables. Have students complete EA-ITP-GW, Part I, page 20.		
Objective 16	Discuss the metric system and the relationship between the metric and English systems. Have students complete EA-ITP-GW, Part I, page 21.		

GENERAL
G101 MATHEMATICS AND PHYSICS
SOLVE PROBLEMS USING PRINCIPLES OF MATHEMATICS
G101-A

TECHNICAL INFORMATION SUPPLEMENT #1--Terms and Definitions

A. Addends--Numbers that are added together

B. Sum or total--Answer to an addition problem

C. Minuend--Number from which another number is subtracted

D. Subtrahend--Number which is being subtracted

E. Difference--Answer to a subtraction problem

F. Factors--Numbers that are multipled

G. Product--Answer to a multiplication problem

H. Divisor--Number by which you divide

I. Dividend--Number that is divided

J. Quotient--Answer to a division problem

K. Remainder--Number that may be left over when division is completed

L. Fraction--Numerical representation indicating the quotient of two numbers

EXAMPLES: 5/8, 1/2, 3.75

M. Numerator--Top number of a fraction

EXAMPLE: $\frac{5}{8}$ numerator
denominator

N. Denominator--Bottom number of a fraction

O. Common denominator--Denominator that is divisible by all other denominators in a problem

P. Proper fraction--Fraction in which the numerator is smaller than the denominator

EXAMPLE: 3/9

Q. Improper fraction--Fraction in which the numerator is larger than or equal to the denominator

EXAMPLES: 8/6, 7/7

R. Mixed number--Contains a whole number and a fraction

EXAMPLES: 9 1/2, 4 2/3, 1 7/8

S. Decimal fraction--Fraction in which the denominator is a power of 10 expressed by the decimal point

T. Signed number--Whole number identified with either a positive or negative sign

EXAMPLE: -5, +20

U. Percentage--A part of a whole expressed in hundredths

EXAMPLE: .50 = 50%

V. Ratio--The relationship in quantity, amount, or size between two or more values

W. Proportion--An algebraic relationship in which one ratio is equal to another

X. Power of a number--Amount of times a number is multipled by itself, as indicated by an exponent

EXAMPLE: $4^4 = 4x4x4x4 = 256$

Y. Exponent--A symbol written above and to the right of a mathematical expression to indicate the operation of raising a number to a power

GENERAL
G101 MATHEMATICS AND PHYSICS
SOLVE PROBLEMS USING PRINCIPLES OF MATHEMATICS
G101-A

INSTRUCTIONAL SUPPLEMENT #1 - MATH PROBLEMS

Part I - Whole Numbers

(NOTE: Do not use a calculator to solve these problems.)

1. Find the sum of the following problems. Write your answer in the space below each problem.

a.
$$\begin{array}{r} 576 \\ 953 \\ +\ 462 \\ \hline 615 \end{array}$$

b.
$$\begin{array}{r} 333 \\ 478 \\ +\ 962 \\ \hline 510 \end{array}$$

c.
$$\begin{array}{r} 747 \\ 324 \\ +\ 600 \\ \hline 598 \end{array}$$

d.
$$\begin{array}{r} 342 \\ 636 \\ +\ 877 \\ \hline 965 \end{array}$$

e.
$$\begin{array}{r} 396 \\ 728 \\ +\ 220 \\ \hline 494 \end{array}$$

f.
$$\begin{array}{r} 923 \\ 934 \\ +\ 966 \\ \hline 123 \end{array}$$

g.
$$\begin{array}{r} 327 \\ 240 \\ +\ 136 \\ \hline 238 \end{array}$$

h.
$$\begin{array}{r} 270 \\ 368 \\ +\ 609 \\ \hline 224 \end{array}$$

i.
$$\begin{array}{r} 642{,}865 \\ +\ 921{,}567 \end{array}$$

j.
$$\begin{array}{r} 784{,}298 \\ +\ 843{,}427 \end{array}$$

k.
$$\begin{array}{r} 372{,}486 \\ +\ 683{,}769 \end{array}$$

l.
$$\begin{array}{r} 478{,}695 \\ +\ 341{,}287 \end{array}$$

m.
$$\begin{array}{r} 5{,}974 \\ 8{,}362 \\ 6{,}099 \\ +\ 7{,}674 \\ \hline 3{,}032 \end{array}$$

n.
$$\begin{array}{r} 5{,}463 \\ 2{,}143 \\ 8{,}913 \\ +\ 6{,}884 \\ \hline 4{,}192 \end{array}$$

o.
$$\begin{array}{r} 3{,}718 \\ 8{,}932 \\ 5{,}775 \\ +\ 3{,}761 \\ \hline 9{,}514 \end{array}$$

p.
$$\begin{array}{r} 64{,}515 \\ 30{,}607 \\ 78{,}083 \\ 51{,}341 \\ \hline 63{,}677 \end{array}$$

2. Find the difference of the following problems. Write your answer in the space below each problem.

a. 75 - 56	b. 84 - 57	c. 4,635 - 3,187	d. 4,178 - 1,539
e. 218 - 119	f. 983 - 656	g. 771 - 289	h. 53 - 39
i. 74 - 26	j. 62 - 29	k. 77 - 39	l. 123 - 67
m. 111 - 79	n. 204 - 78	o. 356 - 178	p. 378 - 179
q. 4,890 - 362	r. 365 - 209	s. 6,720 - 4,890	t. 7,650 - 2,312
u. 336 - 249	v. 397 - 298		w. 365 - 287
x. 175 - 96	y. 1,260 - 357		z. 2,545 - 1,759
aa. 4,815 - 3,927	bb. 51,425 - 50,535		cc. 27,312 - 25,497
dd. 19,621 - 18,146	ee. 6,783 - 2,499		ff. 577 - 199
gg. 30,020 - 9,999	hh. 75,892 - 3,475		ii. 167,890 - 98,002

3. Find the product of the following problems. Write your answer in the space below each problem.

a. 174 x 246	b. 275 x 832	c. 351 x 350	d. 485 x 164	e. 463 x 256
f. 876 x 367	g. 564 x 459	h. 548 x 740	i. 318 x 176	j. 768 x 385
k. 892 x 864	l. 719 x 396	m. 728 x 830	n. 654 x 951	o. 913 x 537
p. 825 x 619	q. 586 x 741	r. 483 x 921	s. 375 x 381	t. 483 x 926

4. Find the quotient of the following problems. Write your answer in the space below each problem. Give only the whole number as your answer.

a. $29\overline{)8,507}$ b. $62\overline{)7,739}$ c. $28\overline{)5,212}$

d. $34\overline{)5,950}$ e. $17\overline{)8,364}$ f. $71\overline{)18,318}$

g. $43\overline{)10,965}$ h. $56\overline{)7,616}$ i. $92\overline{)30,084}$

j. $37\overline{)26,679}$ k. $7\overline{)4,228}$ l. $15\overline{)24,090}$

m. $15,\overline{)4,530}$ n. $26\overline{)52,260}$ o. $13\overline{)91,169}$

p. $34\overline{)17,238}$ q. $36\overline{)10,080}$ r. $17\overline{)53,040}$

s. $321\overline{)110,424}$ t. $417\overline{)12,093}$ u. $558\overline{)65,844}$

v. $713\overline{)161,149}$ w. $308\overline{)165,432}$ x. $12\overline{)24}$

y. $30\overline{)90}$ z. $66\overline{)198}$ aa. $15\overline{)60}$

bb. $23\overline{)276}$ cc. $19\overline{)152}$ dd. $86\overline{)1,032}$

ee. $11\overline{)121}$ ff. $35\overline{)1,225}$ gg. $52\overline{)468}$

hh. $73\overline{)1,095}$ ii. $20\overline{)400}$ jj. $47\overline{)1,175}$

kk. $79\overline{)632}$ ll. $99\overline{)396}$

INSTRUCTIONAL SUPPLEMENT #1

Part II - Fractions

1. Match the following fractions with the correct shaded figures. There are more figures than fractions.

_____a. 4/8

_____b. 2/2

_____c. 6/16

_____d. 3/7

_____e. 5/5

_____f. 1/2

_____g. 2/7

_____h. 5/6

_____i. 1/4

_____j. 2/3

_____k. 7/8

_____l. 3/5

_____m. 2/8

_____n. 3/3

_____o. 1/5

1.

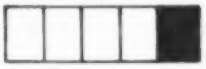
2.

3.

4.

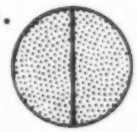
5.

6.

7. 

8.

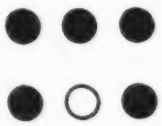
9.

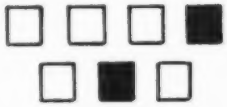
10. 

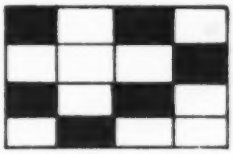
11.

12.

13.

14. 

15. 

16. 

2. Change each of the following fractions to a new fraction with the indicated denominator.

Example: 1/5 = _____/25 1/5 x 5/5 = 5/25

a. 1/2 = _____/4

b. 3/5 = _____/25

c. 30/5 = _____/1

d. 4/4 = _____/1

e. 3/8 = _____/24

f. 33/36 = _____/12

g. 5/7 = _____/14

h. 15/24 = _____/8

i. 14/21 = _____/3

j. 10/11 = _____/121

3. Use a "P" for proper, "I" for improper, or "M" for mixed numbers to identify the following.

_____a. 1/5

_____b. 6 2/3

_____c. 7/5

_____d. 4/1

_____e. 3 1/5

_____f. 2/3

_____g. 2 1/2

_____h. 8/4

_____i. 8 1/3

_____j. 4/7

4. Rename each of the following fractions as indicated.

a. 2/3 = _____/6

b. 1/5 = _____/10

c. 3/4 = _____/12

d. 3/4 = _____/8

e. 7/9 = _____/27

f. 4/8 = _____/4

g. 1/3 = _____/9

h. 4/10 = _____/5

i. 1/10 = _____/100

j. 10/25 = _____/5

5. Add the following like fractions. Reduce to lowest terms.

a. 2/5 + 1/5 =
b. 1/3 + 1/3 =
c. 1/2 + 1/2 =
d. 1/4 + 2/4 =
e. 3/6 + 1/6 =
f. 4/10 + 1/10 =
g. 3/11 + 2/11 =
h. 7/12 + 3/12 =
i. 3/15 + 7/15 =
j. 7/12 + 2/12 =
k. 3/7 + 1/7 =
l. 2/5 + 4/5 =
m. 5/5 + 3/5 =
n. 1/5 + 3/5 =
o. 4/7 + 1/7 =
p. 3/4 + 1/4 =
q. 7/10 + 1/10 =
r. 4/11 + 9/11 =
s. 1/3 + 2/3 =
t. 9/15 + 1/15 =
u. 5/6 + 2/6 =
v. 6/12 + 1/12 =
w. 1/9 + 8/9 =
x. 7/10 + 9/10 =
y. 1/8 + 7/8 =

6. Add the following unlike fractions. Reduce to lowest terms.

a. 2/5 + 1/10 =
b. 1/3 + 4/12 =
c. 3/7 + 2/14 =
d. 1/7 + 2/8 =
e. 3/6 + 2/3 =
f. 4/10 + 3/15 =
g. 4/5 + 3/4 =
h. 5/8 + 3/16 =
i. 4/5 + 1/6 =
j. 2/7 + 1/4 =
k. 5/7 + 2/3 =
l. 7/11 + 3/33 =
m. 1/5 + 4/8 =
n. 3/5 + 4/7 =
o. 1/6 + 2/4 =
p. 1/6 + 3/9 =
q. 4/6 + 3/7 =
r. 1/2 + 4/8 =
s. 1/3 + 4/10 =
t. 7/9 + 5/6 =
u. 3/5 + 1/3 =
v. 7/8 + 6/7 =

7. Add the following fractions. Reduce your answer to lowest terms.

   a. 1/2 + 1/2 =

   b. 2/3 + 1/9 =

   c. 4/16 + 3/8 =

   d. 1/7 + 9/7 =

   e. 2/3 + 4/5 =

8. Add the following mixed numbers.

   a. 2 1/7 + 3 2/8 =

   b. 4 1/8 + 2 1/4 =

   c. 6 7/8 + 1 1/8 =

   d. 3 3/4 + 3/2 =

   e. 12 3/16 + 4 1/4 =

   f. 5 1/2 + 6 2/3 =

   g. 1 3/20 + 2 3/4 =

   h. 2 1/2 + 4 1/7 =

   i. 6 2/3 + 3 1/6 =

   j. 6 5/6 + 5 1/4 =

   k. 1 3/4 + 2 3/8 =

   l. 3 1/2 + 2 1/8 =

   m. 10 2/5 + 12 3/10 + 2 3/5 =

   n. 17 1/2 + 10 3/5 + 2 3/5 =

   o. 6 5/6 + 1 1/2 + 5 1/4 + 8 5/6 =

   p. 2 2/3 + 7 7/9 =

   q. 3 7/8 + 4 2/3 =

   r. 7 4/6 + 3 1/12 =

   s. 8 7/12 + 9 1/8 =

   t. 4 5/7 + 3 1/5 =

   u. 8 4/7 + 6 1/4 =

   v. 9 2/3 + 5 1/5 =

   w. 8 7/11 + 9 1/10 =

   x. 20 1/3 + 1 1/11 =

   y. 8 1/9 + 1 1/4 =

9. Subtract the following mixed numbers. Reduce your answer to lowest terms.

a. 8 5/6 - 6 1/3 =

b. 11 11/12 - 8 1/4 =

c. 14 3/4 - 3 1/8 =

d. 18 9/10 - 15 2/5 =

e. 42 7/8 - 9 3/16 =

f. 9 3/4 - 1 9/10 =

g. 7 1/6 - 5 3/8 =

h. 18 5/6 - 12 15/16 =

i. 23 3/8 - 11 5/12 =

j. 24 7/12 - 14 7/10 =

k. 6 7/8 - 2 3/8 =

l. 2 1/2 - 1 3/4 =

m. 8 1/4 - 4 2/5 =

n. 11 1/2 - 2 1/3 =

o. 14 3/8 - 9 1/10 =

p. 8 3/4 - 5 1/6 =

q. 3 7/12 - 1 3/8 =

r. 7 15/16 - 2 5/6 =

s. 13 9/10 - 9 3/4 =

t. 32 13/20 - 27 5/8 =

u. 10 1/3 - 4 1/2 =

v. 13 1/4 - 8 2/3 =

w. 9 1/6 - 2 3/5 =

x. 36 2/3 - 17 7/8 =

y. 25 3/4 - 21 4/5 =

z. 24 9/16 - 8 3/4 =

aa. 21 3/10 - 13 1/4 =

bb. 10 5/6 - 10 7/12 =

cc. 8 7/8 - 7 15/16 =

dd. 4 1/6 - 3 2/3 =

10. Multiply the following fractions. Reduce your answer to lowest terms.

a. 1/2 x 3/4 =
b. 2/3 x 4/5 =
c. 5/6 x 11/12 =
d. 3/4 x 2/5 =
e. 3/5 x 6/7 =
f. 2/3 x 2/5 =
g. 2/5 x 1/2 =
h. 7/8 x 5/6 =
i. 3/7 x 2/5 =
j. 7/9 x 4/5 =
k. 2/5 x 3/7 =
l. 4/5 x 7/9 =
m. 5/9 x 2/7 =
n. 3/16 x 9/5 =
o. 2/7 x 5/9 =
p. 2/3 x 5/7 =
q. 5/6 x 13/14 =
r. 1/5 x 6/7 =
s. 2/9 x 2/3 =
t. 3/8 x 11/12 =
u. 1/2 x 1/3 =
v. 2/5 x 2/3 =
w. 2/3 x 5/7 =
x. 5/8 x 7/9 =
y. 1/3 x 1/2 =
z. 2/8 x 2/5 =
aa. 5/7 x 2/8 =
bb. 2/3 x 5/8 =
cc. 4/5 x 1/8 =
dd. 2/3 x 7/8 =

11. Multiply the following fractions. Reduce your answer to lowest terms.

a. 5/6 x 9/20 =
b. 4/5 x 15/16 =
c. 3/8 x 8/9 =
d. 20 x 5/6 =
e. 12 x 7/8 =
f. 4 x 5/16 =
g. 2 1/16 x 1 1/3 =
h. 3 1/2 x 2 1/10 =
i. 10 1/8 x 7 1/9 =
j. 7/10 x 8/21 =
k. 2/5 x 7/10 =
l. 3/4 x 16/27 =
m. 6 x 7/32 =
n. 24 x 3/4 =
o. 18 x 31/64 =
p. 2 3/16 x 3 1/7 =
q. 5 5/8 x 4/9 =
r. 1 13/32 x 3/10 =
s. 24/10 x 5/8 =
t. 7/24 x 4/7 =

12. Divide the following fractions. Reduce your answer to lowest terms.

a. 1/3 ÷ 1/2 =

b. 1/2 ÷ 1/3 =

c. 1/4 ÷ 3/4 =

d. 1/7 ÷ 1/3 =

e. 4/8 ÷ 2/8 =

f. 6/7 ÷ 3/4 =

g. 5/6 ÷ 1/5 =

h. 5/7 ÷ 3/5 =

i. 1/2 ÷ 1/2 =

j. 2/3 ÷ 1/5 =

k. 4/5 ÷ 1/8 =

l. 7/9 ÷ 1/3 =

m. 5/7 ÷ 4/5 =

n. 1/3 ÷ 7/9 =

o. 10/12 ÷ 1/3 =

p. 4 1/3 ÷ 2 1/2 =

q. 7 2/5 ÷ 2 1/2 =

r. 5 2/3 ÷ 1 4/5 =

s. 5 ÷ 6 1/4 =

t. 3 1/3 ÷ 1 2/5 =

u. 3 ÷ 2 2/3 =

v. 6 1/4 ÷ 3 1/3 =

w. 1 1/2 ÷ 1 1/5 =

x. 2/16 ÷ 4/16 =

y. 1/8 ÷ 1/4 =

z. 3/4 ÷ 6/7 =

aa. 1/5 ÷ 5/6 =

bb. 2/3 ÷ 1/4 =

cc. 7/8 ÷ 9/10 =

dd. 12/16 ÷ 5/8 =

ee. 13/16 ÷ 5/6 =

ff. 5/6 ÷ 11/12 =

gg. 9/10 ÷ 3/4 =

hh. 6 1/4 ÷ 5 =

ii. 3 1/5 ÷ 1 1/3 =

jj. 1 5/8 ÷ 1 7/32 =

kk. 4 2/3 ÷ 1 3/5 =

ll. 11 1/4 ÷ 2 1/2 =

mm. 2 1/16 ÷ 1 3/8 =

nn. 2 1/4 ÷ 3 3/8 =

oo. 1 3/5 ÷ 3 1/5 =

pp. 4 1/2 ÷ 3/5 =

qq. 2 2/3 ÷ 7 1/2 =

rr. 3 3/4 ÷ 4 2/5 =

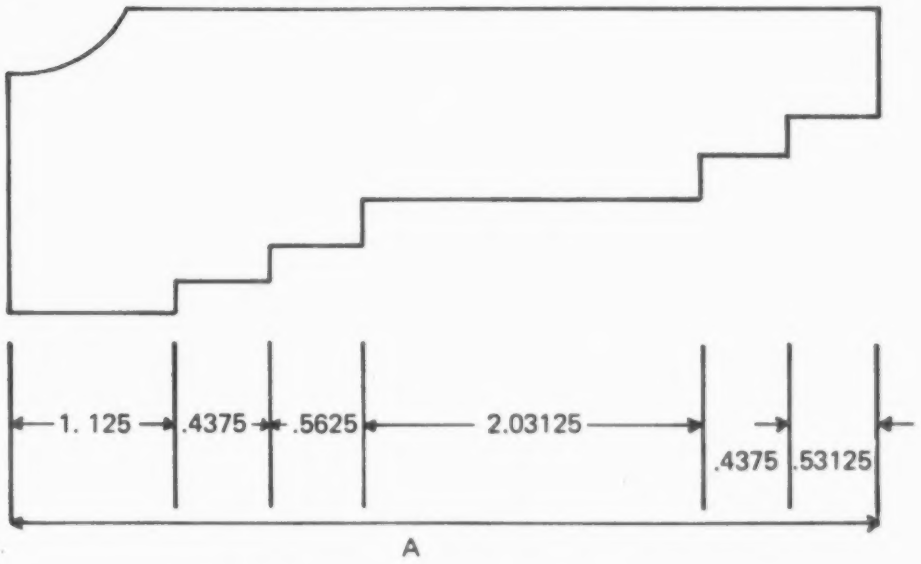
ss. 1 7/8 ÷ 1 1/3 =

INSTRUCTIONAL SUPPLEMENT #1

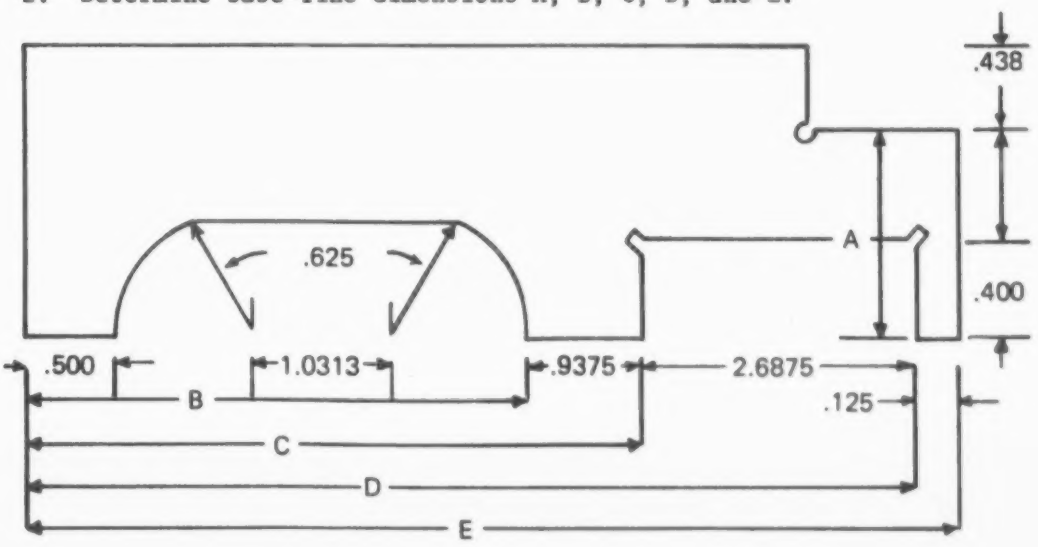
Part III - Decimal fractions and percentages

(NOTE: Do not use a calculator to solve these problems.)

1. Compute the overall dimension A of the template below.



2. Determine base-line dimensions A, B, C, D, and E.



a. _____ d. _____

b. _____ e. _____

c. _____

3. Match the correct decimal notation of each of the following.

_____a.	3 3/10	1.	24.07
_____b.	20 2/10	2.	3.003
_____c.	5 15/1,000	3.	18.88
_____d.	3 3/100	4.	9.00003
_____e.	12 63/1,000	5.	27.000007
_____f.	24 7/100	6.	20.2
_____g.	9 3/100,000	7.	3.03
_____h.	3 3/1,000	8.	12.063
_____i.	18 88/100	9.	5.015
_____j.	27 7/1,000,000	10.	3.3

4. Write the following numbers in decimal notation.

a. 56 5/10

b. 200 7/100

c. 88 88/1,000

d. 12 6/10,000

e. 27 56/1,000

f. 82 63/100

g. 34 23/100,000

h. 28 8/100

i. 39 3/10

j. 5 55/1,000

5. Express each of the following fractions as a decimal.

   a. 1/8

   b. 1/4

   c. 1/2

   d. 3/4

   e. 5/8

   f. 7/20

   g. 7/16

   h. 1/9

   i. 4/9

   j. 4/5

6. Express each of the following fractions as a percent.

   a. 1/4

   b. 2/9

   c. 7/10

   d. 3/4

   e. 2/2

   f. 9/11

   g. 1/3

   h. 4/9

   i. 2/6

   j. 5/8

7. Express each of the following percents as a fraction.

   a. 50%

   b. 25%

   c. 33 1/3%

   d. 36%

   e. 28%

   f. 14 2/7%

   g. 21%

   h. 45%

   i. 66 2/3%

   j. 70%

8. Express each of the following percents as a decimal.

   a. 47%

   b. 15%

   c. 33.3%

   d. 62%

   e. 75%

   f. 3%

   g. 16.8%

   h. 9%

   i. 10%

   j. 50%

9. Express each of the following decimals as a fraction.

   a. 0.5

   b. 0.8

   c. 0.7

   d. 0.25

   e. 0.68

   f. 0.55

   g. 0.94

   h. 0.375

   i. 0.875

   j. 0.212

10. Express each of the following decimals as a percent.

   a. 0.12

   b. 0.19

   c. 0.7

   d. 0.29

   e. 0.37

   f. 0.42

   g. 0.5

   h. 0.523

   i. 0.746

   j. 03.75

11. Divide the following problems.

a. $.5\overline{)4.5}$

b. $.4\overline{)4.96}$

c. 19.8 ÷ .6 =

d. 10.71 ÷ .07 =

e. .225 ÷ .15 =

f. 1.7608 ÷ .0062 =

g. .48/.6 =

h. .125/.25 =

i. .9/.003 =

j. 1.16/2.9 =

k. $.3\overline{)75}$

l. 108 ÷ .09 =

m. 84 ÷ .007 =

n. 459 ÷ 2.7 =

o. 64 ÷ .16 =

p. 125/.25 =

q. 34/8.5 =

r. 6/.12 =

s. 406/.029 =

t. 8,433/.09 =

12. Divide the following problems.

a. $5\overline{)5.85}$

b. $12\overline{)8.16}$

c. $51\overline{)9.18}$

d. $19\overline{).665}$

e. $1.25\overline{)2.125}$

f. $4\overline{).8}$

g. $41\overline{)32.39}$

h. $81\overline{).3078}$

i. $62\overline{)96.72}$

j. $26\overline{)16.484}$

k. $2\overline{).38}$

l. $63\overline{)1.764}$

m. $44\overline{)13.376}$

n. $47\overline{)3.948}$

o. $94\overline{)2,368.8}$

13. Multiply these problems.

a. $\frac{287}{100}$	b. $\frac{.0351}{10}$	c. $\frac{30.99}{100}$	d. $\frac{4.45}{1,000}$	e. $\frac{64.8}{10}$
f. $\frac{.3967}{100}$	g. $\frac{37.8}{100}$	h. $\frac{.0064}{1,000}$	i. $\frac{.3684}{10}$	j. $\frac{.0064}{10}$

14. Multiply these problems.

a. 69.239 x 100 =

b. 5.766 x 10,000 =

c. 2,801 x 10 =

d. 8.16 x 100 =

e. 8.108 x 100 =

f. .892 x 10 =

g. 6.69 x 1,000 =

h. 47.3 x 100 =

i. .0957 x 100 =

j. 61.75 x 10 =

GENERAL
G101 MATHEMATICS AND PHYSICS
SOLVE PROBLEMS USING PRINCIPLES OF MATHEMATICS
G101-A

ANSWERS TO INSTRUCTIONAL SUPPLEMENT #1

Part 1 - Whole Numbers

1.

a. 2,606	e. 1,838	i. 1,564,432	m. 31,141
b. 2,283	f. 2,946	j. 1,627,725	n. 27,595
c. 2,269	g. 941	k. 1,056,255	o. 31,700
d. 2,820	h. 1,471	l. 819,982	p. 288,223

2.

a. 19	k. 38	u. 87	ee. 4,284
b. 27	l. 56	v. 99	ff. 378
c. 1,448	m. 32	w. 78	gg. 20,021
d. 2,639	n. 126	x. 79	hh. 72,417
e. 99	o. 178	y. 903	ii. 69,888
f. 327	p. 199	z. 786	
g. 482	q. 4,528	aa. 888	
h. 14	r. 156	bb. 890	
i. 48	s. 1,830	cc. 1,815	
j. 33	t. 5,338	dd. 1,475	

3.

a. 42,804	f. 321,492	k. 770,688	p. 510,675
b. 228,800	g. 258,876	l. 284,724	q. 434,226
c. 122,850	h. 405,520	m. 604,240	r. 444,843
d. 79,540	i. 55,968	n. 621,954	s. 142,875
e. 118,528	j. 295,680	o. 490,281	t. 447,258

4.

a. 293	h. 136	o. 7,013	v. 226
b. 124	i. 327	p. 507	w. 537
c. 186	j. 721	q. 280	x. 2
d. 175	k. 604	r. 3,120	y. 3
e. 492	l. 1,606	s. 344	z. 3
f. 258	m. 302	t. 29	aa. 4
g. 255	n. 2,010	u. 118	bb. 12

cc. 8	hh. 15
dd. 12	ii. 20
ee. 11	jj. 25
ff. 35	kk. 8
gg. 9	ll. 4

ANSWERS TO INSTRUCTIONAL SUPPLEMENT #1

Part II - Fractions

1.
a. 4
b. 10
c. 16
d. 6
e. 9
f. 3
g. 15
h. 14
i. 2
j. 11
k. 13
l. 12
m. 1
n. 5
o. 7

2.
a. 2
b. 15
c. 6
d. 1
e. 9
f. 11
g. 10
h. 5
i. 2
j. 110

3.
a. P
b. M
c. I
d. I
e. M
f. P
g. M
h. I
i. M
j. P

4.
a. 4
b. 2
c. 9
d. 6
e. 21
f. 2
g. 3
h. 2
i. 10
j. 2

5.
a. 3/5
b. 2/3
c. 1
d. 3/4
e. 2/3
f. 1/2
g. 5/11
h. 5/6
i. 2/3
j. 3/4
k. 4/7
l. 6/5 or 1 1/5
m. 8/5 or 1 3/5
n. 4/5
o. 5/7
p. 1
q. 4/5
r. 13/11 or 1 2/11
s. 1
t. 2/3
u. 7/6 or 1 1/6
v. 7/12
w. 1
x. 8/5 or 1 3/5
y. 1

6.
a. 1/2
b. 2/3
c. 4/7
d. 11/28
e. 7/6 or 1 1/6
f. 3/5
g. 31/20 or 1 11/20
h. 13/16
i. 29/30
j. 15/28
k. 1 8/21
l. 8/11
m. 7/10
n. 41/35 or 1 6/35
o. 2/3
p. 1/2
q. 1 2/21
r. 1
s. 11/15
t. 1 11/18
u. 14/15
v. 1 41/56

7. a. 1
   b. 7/9
   c. 5/8
   d. 10/7 or 1 3/7
   e. 1 7/15

8. a. 5 11/28
   b. 6 3/8
   c. 8
   d. 5 1/4
   e. 16 7/16
   f. 12 1/6
   g. 3 9/10
   h. 6 9/14
   i. 9 5/6
   j. 12 1/12
   k. 4 1/8
   l. 5 5/8
   m. 25 3/10
   n. 30 7/10
   o. 22 5/12
   p. 10 4/9
   q. 8 13/24
   r. 10 3/4
   s. 17 17/24
   t. 7 32/35
   u. 14 23/28
   v. 14 13/15
   w. 17 81/110
   x. 21 14/33
   y. 9 13/36

9. a. 2 1/2
   b. 3 2/3
   c. 11 5/8
   d. 3 1/2
   e. 33 11/16
   f. 7 17/20
   g. 1 19/24
   h. 5 43/48
   i. 11 23/24
   j. 9 53/60
   k. 4 1/2
   l. 3/4
   m. 3 17/20
   n. 9 1/6
   o. 5 11/40
   p. 3 7/12
   q. 2 5/24
   r. 5 5/48
   s. 4 3/20
   t. 5 1/40
   u. 5 5/6
   v. 4 7/12
   w. 6 17/30
   x. 18 19/24
   y. 3 19/20
   z. 15 13/16
   aa. 8 1/20
   bb. 1/4
   cc. 15/16
   dd. 1/2

10. a. 3/8
    b. 8/15
    c. 55/72
    d. 3/10
    e. 18/35
    f. 4/15
    g. 1/5
    h. 35/48
    i. 6/35
    j. 28/45
    k. 6/35
    l. 28/45
    m. 10/63
    n. 27/80
    o. 10/63
    p. 10/21
    q. 65/84
    r. 6/35
    s. 4/27
    t. 11/32
    u. 1/6
    v. 4/15
    w. 10/21
    x. 35/72
    y. 1/6
    z. 1/10
    aa. 5/28
    bb. 5/12
    cc. 1/10
    dd. 7/12

ANSWERS TO INSTRUCTIONAL SUPPLEMENT #1

11.
a. 3/8
b. 3/4
c. 1/3
d. 16 2/3
e. 10 1/2
f. 1 1/4
g. 2 3/4
h. 7 7/20
i. 72
j. 4/15
k. 7/25
l. 4/9
m. 1 5/16
n. 18
o. 8 23/32
p. 6 7/8
q. 2 1/2
r. 27/64
s. 1 1/2
t. 1/6

12.
a. 2/3
b. 1 1/2 or 3/2
c. 1/3
d. 3/7
e. 2
f. 8/7 or 1 1/7
g. 25/6 or 4 1/6
h. 25/21 or 1 4/21
i. 1
j. 10/3 or 3 1/3
k. 32/5 or 6 2/5
l. 7/3 or 2 1/3
m. 25/28
n. 3/7
o. 5/2 or 2 1/2
p. 26/15 or 1 11/15
q. 74/25 or 2 24/25
r. 85/27 or 3 4/27
s. 4/5
t. 50/21 or 2 8/21
u. 9/8 or 1 1/8
v. 15/8 or 1 7/8
w. 5/4 or 1 1/4
x. 1/2
y. 1/2
z. 7/8
aa. 6/25
bb. 8/3 or 2 2/3
cc. 35/36
dd. 6/5 or 1 1/5
ee. 39/40
ff. 10/11
gg. 6/5 or 1 1/5
hh. 1 1/4
ii. 2 2/5
jj. 4/3 or 1 1/3
kk. 35/12 or 2 11/12
ll. 9/2 or 4 1/2
mm. 3/2 or 1 1/2
nn. 2/3
oo. 1/2
pp. 15/2 or 7 1/2
qq. 16/45
rr. 75/88
ss. 45/32 or 1 13/32

ANSWERS TO INSTRUCTIONAL SUPPLEMENT #1

Part III - Decimal fractions and percentages

1. A = 5.12500

2. a. A = .838
   b. B = 2.7813
   c. C = 3.7188
   d. D = 6.4063
   e. E = 6.5313

3. a. 10
   b. 6
   c. 9
   d. 7
   e. 8
   f. 1
   g. 4
   h. 2
   i. 3
   j. 5

4. a. 56.5
   b. 200.07
   c. 88.088
   d. 12.0006
   e. 27.056
   f. 82.63
   g. 34.00023
   h. 28.08
   i. 39.3
   j. 5.055

5. a. .125
   b. .25
   c. .50
   d. .75
   e. .625
   f. .35
   g. .4375
   h. .1111---
   i. .444---
   j. .80

6. a. 25%
   b. 22.22%
   c. 70%
   d. 75%
   e. 100%
   f. 81.81%
   g. 33.33%
   h. 44.44%
   i. 33.33%
   j. 62.5%

7. a. 1/2
   b. 1/4
   c. 1/3
   d. 9/25
   e. 7/25
   f. 1/7
   g. 21/100
   h. 9/20
   i. 2/3
   j. 7/10

8. a. .47
   b. .15
   c. .333
   d. .62
   e. .75
   f. .03
   g. .168
   h. .09
   i. .10
   j. .50

ANSWERS TO INSTRUCTIONAL SUPPLEMENT #1

9.
a. 1/2
b. 4/5
c. 7/10
d. 1/4
e. 17/25
f. 11/20
g. 47/50
h. 3/8
i. 7/8
j. 53/250

10.
a. 12%
b. 19%
c. 70%
d. 29%
e. 37%
f. 42%
g. 50%
h. 52.3%
i. 74.6%
j. 375%

11.
a. 9
b. 12.4
c. 33
d. 153
e. 1.5
f. 284
g. .8
h. .5
i. .300
j. .4
k. 250
l. 1,200
m. 12,000
n. 170
o. 400
p. 500
q. 4
r. 50
s. 14,000
t. 93,700

12.
a. 1.17
b. .68
c. .18
d. .035
e. 1.7
f. .2
g. .79
h. .0038
i. 1.56
j. .634
k. .19
l. .028
m. .304
n. .084
o. 25.2

13.
a. 28,700
b. .351
c. 3,099
d. 4,450
e. 648
f. 39.67
g. 3,780
h. 6.4
i. 3,684
j. .064

14.
a. 6,923.9
b. 57,660
c. 28,010
d. 816
e. 810.8
f. 8.92
g. 6,690
h. 4,730
i. 9.57
j. 617.5

GENERAL
G101 MATHEMATICS AND PHYSICS
SOLVE PROBLEMS USING PRINCIPLES OF MATHEMATICS
G101-A

THEORY TEST

1. Match terms related to the principles of mathematics to their correct definitions. Write the correct numbers in the blanks.

_____a.	Numbers that are added together	1.	Fraction
_____b.	Fraction in which the numerator is smaller than the denominator	2.	Improper fraction
_____c.	Numerical representation indicating the quotient of two numbers	3.	Difference
_____d.	Number that is divided	4.	Addends
_____e.	Answer to a division problem	5.	Minuend
_____f.	Answer to an addition problem	6.	Quotient
_____g.	Answer to a multiplication problem	7.	Sum or total
_____h.	Answer to a subtraction problem	8.	Dividend
_____i.	Fraction in which the numerator is larger than or equal to the denominator	9.	Product
_____j.	Number from which another number is subtracted	10.	Proper fraction
_____k.	Contains a whole number and a fraction	11.	Mixed number
_____l.	Number which is being subtracted	12.	Subtrahend
_____m.	Number by which you divide	13.	Numerator
_____n.	Numbers that are multiplied	14.	Factors
_____o.	Number that may be left over when division is completed	15.	Remainder
_____p.	A part of a whole expressed in hundredths	16.	Percentage
_____q.	Top number of a fraction	17.	Divisor

_____r. Fraction in which the denominator is a power of 10 expressed by the decimal point

_____s. Denominator that is divisible by all other denominators in a problem

_____t. The relationship in quantity, amount, or size between two or more values

_____u. Bottom number of a fraction

_____v. Whole number identified with either a positive or negative sign

_____w. An algebraic relationship in which one ratio is equal to another

_____x. A symbol written above and to the right of a mathematical expression to indicate the operation of raising a number to a power

_____y. Amount of times a number is multiplied by itself, as indicated by an exponent

18. Decimal fraction
19. Ratio
20. Common denominator
21. Proportion
22. Exponent
23. Power of a number
24. Denominator
25. Signed number

2. Convert the following digits between the decimal number and binary number systems.

a. Convert decimal numbers to binary numbers by filling in the chart below.

Binary Numbers							Decimal Numbers
64	32	16	8	4	2	1	
							7
							27
							127
							76
							59

b. Convert decimal numbers to binary numbers by filling in the chart below.

Binary Numbers							Decimal Numbers
64	32	16	8	4	2	1	
0	1	1	1	1	0	0	
1	1	0	1	1	1	0	
0	0	1	0	0	1	0	
1	1	1	0	0	0	0	
1	0	1	1	1	1	1	

3. Add, subtract, multiply, or divide the following whole number problems. Round off answers to division problems to the nearest hundredth.

a. 331 + 14,479

b. 2047 + 953

c. 100,991 + 19,009

d. 5,577 + 5,533

e. 14,479 - 331

f. 2,047 - 953

g. 100,991 - 19,009

h. 5,577 - 5,533

i. 14,479 x 331

j. 2,047 x 953

k. 100,991 x 19,009

l. 5,577 x 5,533

m. $331\overline{)14,479}$

n. $953\overline{)2,047}$

o. $19,009\overline{)100,991}$

p. $5,533\overline{)5,577}$

4. Add, subtract, multiply, or divide the following decimal fractions.

a. 14.479 + .331

b. .2047 + .953

c. 10.0991 + 1.9009

d. 5.577 + 55.33

e. 14.479 - .331

f. .9530 - .2047

g. 10.0991 - 1.9009

h. 55.33 - 5.577

i. 14.479 x .331

j. .953 x .2047

k. 10.0991 x 1.9009

l. 55.33 x 5.577

m. $.331\overline{)14.479}$

n. $.953\overline{)2047}$

o. $1.9009\overline{)10.0991}$

p. $5.577\overline{)55.33}$

5. Multiply and divide the following problems by scientific notation.

a. $6.3\times10^{4} \times 6.3\times10^{4}$

b. $12.0\times10^{16} \times 4.0\times10^{16}$

c. $64\times10^{3} \times 10\times10^{2}$

d. $45\times10^{6} \times 5\times10^{3}$

e. $\frac{6.3\times10^{4}}{6.3\times10^{4}}$

f. $\frac{12.0\times10^{16}}{4.0\times10^{16}}$

g. $\frac{64\times10^{3}}{10\times10^{2}}$

h. $\frac{45\times10^{6}}{5\times10^{3}}$

6. Add, subtract, multiply, or divide the following common fractions.

a. $1/2 + 1/4 =$

b. $1/16 + 3/32 =$

c. $3/8 + 3/32 =$

d. $7/16 + 3/4 =$

e. 1/2 - 1/4 =

f. 3/32 - 1/16 =

g. 3/8 - 3/32 =

h. 3/4 - 7/16 =

i. 1/2 x 1/4 =

j. 3/32 x 1/16 =

k. 3/8 x 3/32 =

l. 3/4 x 7/16 =

m. 1/2 ÷ 1/4 =

n. 3/32 ÷ 1/16 =

o. 3/8 ÷ 3/32 =

p. 3/4 ÷ 7/16 =

7. Add or subtract the following mixed numbers.

a.
$$\begin{array}{r} 2\ 7/16 \\ +\ 1\ 1/2 \\ \hline \end{array}$$

b.
$$\begin{array}{r} 3\ 5/16 \\ +\ 5\ 3/32 \\ \hline \end{array}$$

c.
$$\begin{array}{r} 4\ 5/16 \\ +\ 9\ 7/64 \\ \hline \end{array}$$

d.
$$\begin{array}{r} 11\ 2/3 \\ +\ 4\ 5/16 \\ \hline \end{array}$$

e. $2\ 7/16 - 1\ 1/2$

f. $5\ 3/32 - 4\ 5/16$

g. $9\ 7/64 - 4\ 5/16$

h. $11\ 2/3 - 4\ 5/6$

8. Use conversion tables to convert the following numbers to either common fractions or decimal fractions as indicated. Tables are at the end of the test.

a. .2500 = ___/4 b. .1250 = ___/8 c. .3750 = ___/8 d. .6250 = ___/8

e. $\frac{13}{16}$ = .___ f. $\frac{13}{64}$ = .___ g. $\frac{25}{64}$ = .___ h. $\frac{29}{32}$ = .___

9. Add, subtract, multiply, and divide signed numbers as indicated. Round off answers to division problems to the nearest hundredth.

a. -78 + 46 = _____ b. -55 + 115 = _____

c. -76 + 24 = _____ d. -35 + 241 = _____

e. -78 + 46 = _____ f. -55 - 115 = _____

g. -76 - 24 = _____ h. -35 - 241 = _____

i. $-78 \times 46 =$ _____

j. $-55 \times -115 =$ _____

k. $-76 \times 24 =$ _____

l. $-35 \times -241 =$ _____

m. $-78 \div 46 =$ _____

n. $-55 \div -115 =$ _____

o. $-76 \div 24 =$ _____

p. $-35 \div -241 =$ _____

10. Convert the following decimal numbers to percentages.

a. .74 = _____%

b. .53 = _____%

c. .11 = _____%

d. .26 = _____%

11. Determine ratios of the following numbers.

a. $\frac{25}{5}$ ____ to 1

b. $\frac{36}{6}$ ____ to 1

c. $\frac{100}{20}$ ____ to 1

d. $\frac{33}{22}$ ____ to 1

12. Solve the following problems involving proportions.

a. $\frac{100}{35}$ as $\frac{x}{7}$

b. $\frac{72}{45}$ as $\frac{x}{5}$

c. $\frac{56}{7}$ as $\frac{x}{1}$

d. $\frac{121}{11}$ as $\frac{x}{7}$

13. Extract the roots or raise the following numbers to a given power.

a. $\sqrt{16}$ = _____

b. $3\sqrt{8}$ = _____

c. $\sqrt{64}$ = _____

d. $\sqrt{121}$ = _____

e. 2^3 = _____

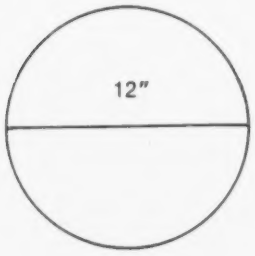
f. 25^2 = _____

g. 10^3 = _____

h. 16^2 = _____

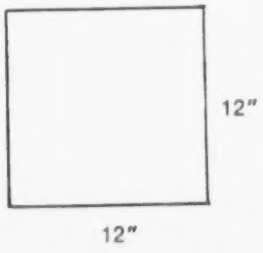
14. Determine areas or volume of the following geometrical shapes. π is 3.14. Round off your answer to the nearest hundredth.

a. $A = \pi r^2$



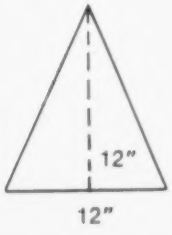
Area _____

b. $A = L \times W$



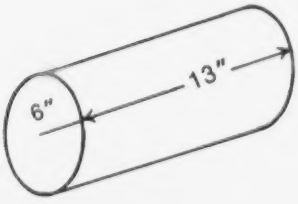
Area _____

c. A right triangle = 1/2 bh



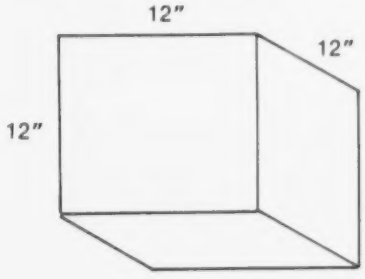
Area _____

d. $V = \pi r^2 h$



Volume _____

e. $A = L \times W \times H$



Volume _____

f. $V = 4/3\ \pi r^3$

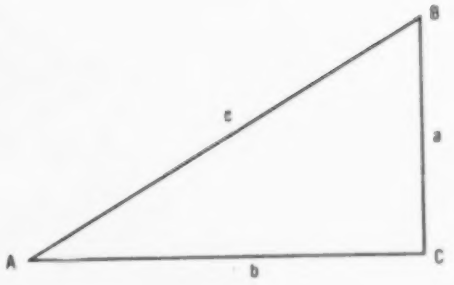
Volume _____

15. Identify the relationships for sine, cosine, and tangent. Write the correct trigonometric functions in the blanks.

_____a. = $\frac{\text{SIDE OPPOSITE}}{\text{HYPOTENUSE}} = \frac{b}{c}$

_____b. = $\frac{\text{SIDE ADJACENT}}{\text{HYPOTENUSE}} = \frac{a}{c}$

_____c. = $\frac{\text{SIDE OPPOSITE}}{\text{SIDE ADJACENT}} = \frac{b}{a}$



C = RIGHT ANGLE
c = HYPOTENUSE
B = ANGLE BEING CONSIDERED
b = SIDE OPPOSITE
a = SIDE ADJACENT

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16. Use conversion tables to convert the following units between the English and the metric systems. Tables are at the end of the test.

a. 91.44 cm = _____yard(s)

b. 1 meter = _____in.

c. 1 mile = _____km

d. 1 km = _____mile

e. 60 mph = _____ft/sec

f. 60 mph = _____km/hr

g. 10 kg. = _____lb

h. 10 lb = _____kg

i. 0.2813 - _____mm

j. 1/4 in. = _____mm

k. 16.669 mm = _____in.

l. 24.209 mm = ._____in.

CONVERSION TABLE

Inches			Decimal Equivalent	Millimeter Equivalent
1/64			.0156	0.397
	1/32		.0313	0.794
3/64			.0469	1.191
		1/16	.0625	1.588
5/64			.0781	1.985
	3/32		.0938	2.381
7/64			.1094	2.778
		1/8	.1250	3.175
9/64			.1406	3.572
	5/32		.1563	3.969
11/64			.1719	4.366
		3/16	.1875	4.762
13/64			.2031	5.159
	7/32		.2188	5.556
15/64			.2344	5.953
		1/4	.2500	6.350
17/64			.2656	6.747
	9/32		.2813	7.144
19/64			.2969	7.541
		5/16	.3125	7.937
21/64			.3281	8.334
	11/32		.3438	8.731
23/64			.3594	9.128
		3/8	.3750	9.525
25/64			.3906	9.922
	13/32		.4063	10.319
27/64			.4219	10.716
		7/16	.4375	11.112
29/64			.4531	11.509
	15/32		.4688	11.905
31/64			.4844	12.303
		1/2	.5000	12.700
33/64			.5156	13.097
	17/32		.5313	13.494
35/64			.5469	13.891
		9/16	.5625	14.287
37/64			.5781	14.684
	19/32		.5938	15.081
39/64			.6094	15.478
		5/8	.6250	15.875
41/64			.6406	16.272
	21/32		.6563	16.669
43/64			.6719	17.067
		11/16	.6875	17.463
45/64			.7031	17.860
	23/32		.7188	18.238
47/64			.7344	18.635
		3/4	.7500	19.049
49/64			.7656	19.446
	25/32		.7813	19.842
51/64			.7969	20.239
		13/16	.8125	20.636
53/64			.8281	21.033
	27/32		.8438	21.430
55/64			.8594	21.827
		7/8	.8750	22.224
57/64			.8906	22.621
	29/32		.9063	23.018
59/64			.9219	23.415
		15/16	.9375	23.812
61/64			.9531	24.209
	31/32		.9688	24.606
63/64			.9844	25.004
		1.0	1.0000	25.400

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CONVERSION TABLE

To Convert From	To	Multiply By
acres	sq ft	4.356×10^{4}
atmospheres	cm Hg at 0°C	76.00
	in. Hg at 0°C	29.92
	lb/sq in	14.696
	bars	1.013
bars	lb/sq in	14.5
Btu	ft-lb	778.26
	kilowatt-hr	2.931×10^{-4}
	joules	1055
Btu/sec	watts	1055
centimeters	in	0.3937
cm Hg	in. H_2O at 4°C	5.354
	lb/sq in	1.934×10^{-1}
cm/second	Ft/sec	3.281×10^{-2}
circular mils	sq in	7.854×10^{-7}
cu centimeters	cu in	6.102×10^{-2}
	U.S. gal	2.642×10^{-4}
cu ft	cu cm	2.832×10^{4}
	U.S. gal	7.481
	liters	28.32
cu ft H_2O	lb	62.428
cu in.	cu cm	16.39
	liters	1.639×10^{-2}
	U.S. gal	4.329×10^{-3}
cu meters	U.S. gal	264.2
deg [arc]	radians	1.745×10^{-2}
feet	meters	3.048×10^{-1}
ft/min	mph	1.136×10^{-2}
	km/hr	1.829×10^{-2}
ft/sec	mph	.6818
	cm/sec	30.48
	knots	.5925

To Convert From	To	Multiply By
ft-lb/min	hp	3.030×10^{-5}
ft-lb/sec	hp	1.818×10^{-3}
	kilowatts	1.356×10^{-3}
fluid oz	dram	8
gal. Imperial	cu in.	277.4
	U.S. gal	1.201
	liters	4.546
gal. U.S. dry	U.S. gal. liquid	1.164
gal. U.S. liquid	cu in.	231.0
grams	oz avdp	3.527×10^{-2}
	lb avdp	2.205×10^{-3}
grams/cm	lb/ft	6.721×10^{-2}
hectopieze	in. Hg	29.53
horsepower	ft-lb/min	33.000
	ft-lb/sec	550
	m-kg/sec	76.04
	kilowatts	7.457×10^{-1}
	Btu/sec	7.068×10^{-1}
horsepower, metric	hp	9.863×10^{-1}
in.	cm	2.540
in. water at 4°C	in. Hg at 0°C	7.355×10^{-2}
kilograms	lb	2.205
	oz	35.27
kilometers	ft	3.281×10^{3}
	miles	6.214×10^{-1}
	nautical miles	5.400×10^{-1}
km/hr	ft/sec	9.113×10^{-1}
	knots	5.396×10^{-1}
	mph	6.214×10^{-1}
kilowatts	Btu/sec	9.480×10^{-1}
	hp	1.341

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CONVERSION TABLE

To Convert From	To	Multiply By
knots	nautical mph	1.0
	ft/sec	1.688
	mph	1.151
liters	cu cm	10^3
	cu in.	61.03
	U.S. gal	2.642×10^{-1}
meters	in.	39.37
	ft	3.281
meter-kilogram	ft-lb	7.233
meter/sec	ft/sec	3.281
microns	in.	3.937×10^{-5}
miles [stat.]	ft	5280
	km	1.609
mph	ft/sec	1.467
	km/hr	1.609
	knots	8.690×10^{-1}
milibars	in. Hg at 0°C	2.953×10^{-2}
nautical miles [naumiles]	ft	6076.1
	miles [stat.]	1.151
	m	1852
ounces, avdp	grams	28.35

To Convert From	To	Multiply By
ounces, fluid	cu in.	1.805
lb/avdp	grams	453.6
	ounces	16.0
lb/cu in.	grams/cu cm	27.68
lb/sq in.	in. Hg at 0°C	2.036
radians	deg [arc]	57.30
radians/sec	deg/sec	57.30
	rev/min	9.549
revolutions	radians	6.283 [2π]
rev/min	radians/sec	1.047×10^{-1}
slug	lb	32.174
sq cm	sq in.	1.550×10^{-1}
sq ft	sq cm	929.0
sq in.	sq cm	6.452
sq meters	sq ft	10.76
sq miles	sq km	2.590
watts	Btu/sec	9.481×10^{-4}

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GENERAL
G101 MATHEMATICS AND PHYSICS
SOLVE PROBLEMS USING PRINCIPLES OF MATHEMATICS
G101-A

ANSWERS TO THEORY TEST

1.

a.	4	n.	14
b.	10	o.	15
c.	1	p.	16
d.	8	q.	13
e.	6	r.	18
f.	7	s.	20
g.	9	t.	19
h.	3	u.	24
i.	2	v.	25
j.	5	w.	21
k.	11	x.	22
l.	12	y.	23
m.	17		

2. (NOTE: Answers are boxed.)

a.

Binary Numbers							Decimal Numbers
64	32	16	8	4	2	1	
0	0	0	0	1	1	1	7
0	0	1	1	0	1	1	27
1	1	1	1	1	1	1	127
1	0	0	1	1	0	0	76
0	1	1	1	0	1	1	59

b.

Binary Numbers							Decimal Numbers
64	32	16	8	4	2	1	
0	1	1	1	1	0	0	60
1	1	0	1	1	1	0	110
0	0	1	0	0	1	0	18
1	1	1	0	0	0	0	112
1	0	1	1	1	1	1	95

ANSWERS TO THEORY TEST

3.	a.	14,810	e.	14,148	i.	4,792,549	m. 43.74
	b.	3,000	f.	1,094	j.	1,950,791	n. 2.15
	c.	120,000	g.	81,982	k.	1,919,737,919	o. 5.31
	d.	11,110	h.	44	l.	30,857,541	p. 1.01
4.	a.	14.810	e.	14.148	i.	4.792549	m. 43.743202
	b.	1.1577	f.	.7483	j.	0.1950791	n. 2147.9538
	c.	12.0000	g.	8.1982	k.	19.197379	o. 5.3127992
	d.	60.907	h.	49.753	l.	308.57541	p. 9.9211045
5.	a.	3.969×10^{9}	c.	6.4×10^{7}	e.	1	g. 64
	b.	4.8×10^{33}	d.	2.25×10^{11}	f.	3×10^{30}	h. 9×10^{3}
6.	a.	3/4	e.	1/4	i.	1/8	m. 2
	b.	5/32	f.	1/32	j.	3/512	n. 1 1/2
	c.	15/32	g.	9/32	k.	9/256	o. 4
	d.	1 3/16	h.	5/16	l.	21/64	p. 1 5/7
7.	a.	3 15/16	e.	15/16			
	b.	8 13/32	f.	25/32			
	c.	13 27/64	g.	4 51/64			
	d.	15 47/48	h.	6 5/6			
8.	a.	1/4	e.	0.8125			
	b.	1/8	f.	0.2031			
	c.	3/8	g.	0.3906			
	d.	5/8	h.	0.9063			
9.	a.	-32	e.	-32	i.	-3,588	m. -1.70
	b.	60	f.	-170	j.	+6,325	n. +0.48
	c.	-52	g.	-100	k.	-1,824	o. -3.17
	d.	206	h.	-276	l.	+8,435	p. +0.15
10.	a.	74%	c.	11%			
	b.	53%	d.	26%			
11.	a.	5	c.	5			
	b.	6	d.	1.5			
12.	a.	20	c.	8			
	b.	8	d.	77			

ANSWERS TO THEORY TEST

13.
- a. 4
- b. 2
- c. 8
- d. 11
- e. 8
- f. 625
- g. 1,000
- h. 256

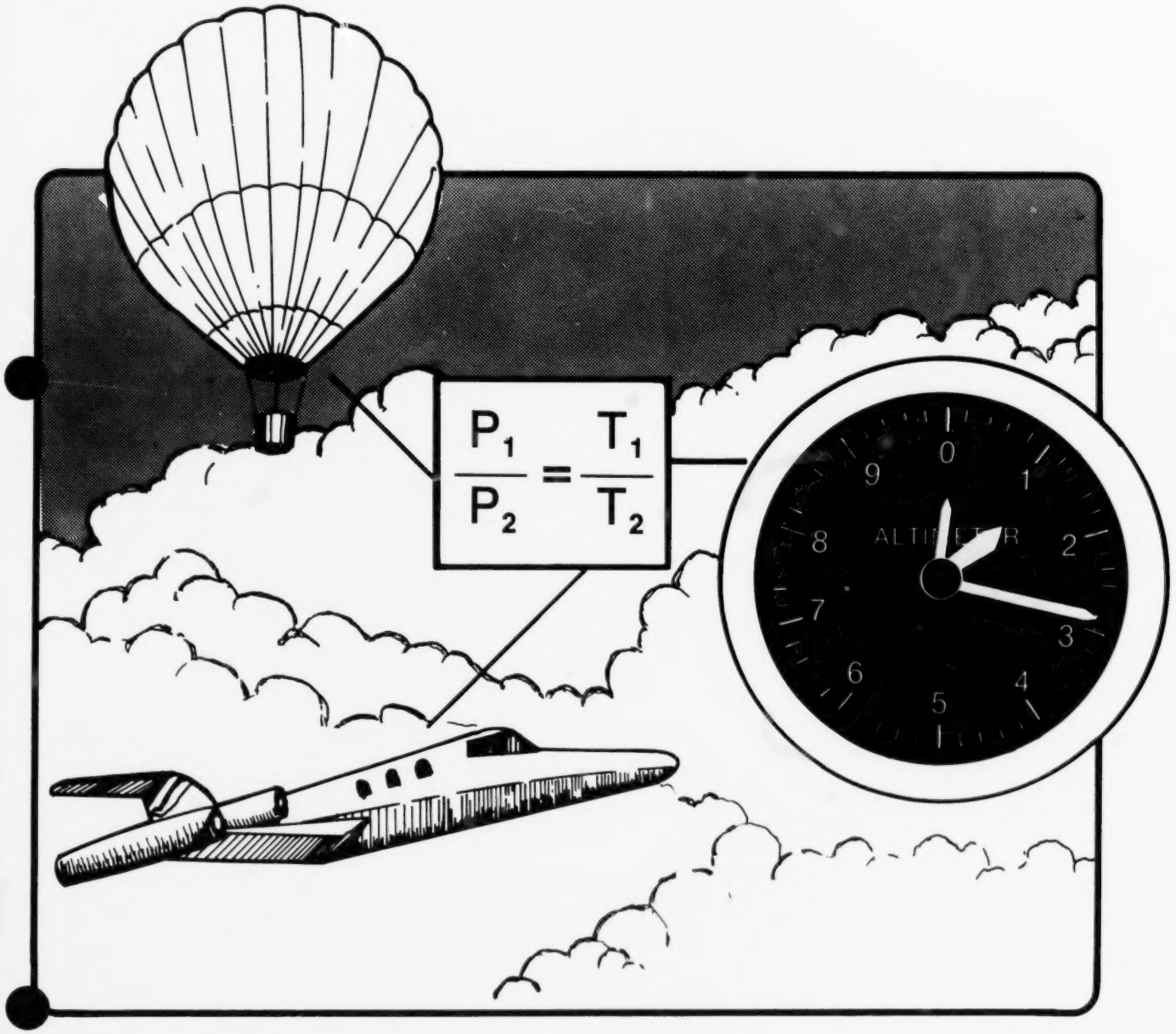
14.
- a. 113.04 sq in.
- b. 144 sq in.
- c. 72 sq in.
- d. 1,469.52 cu in.
- e. 1,728 cu in.
- f. 113.1 cu in.

15.
- a. Sine
- b. Cosine
- c. Tangent

16.
- a. 1 yard
- b. 39.37 in.
- c. 1.609 km
- d. .6214 mile
- e. 88.02 ft/sec
- f. 96.54 km/hr
- g. 22.05 lb
- h. 4.54 kg
- i. 7.144 mm
- j. 6.350 mm
- k. 2 1/32 in.
- l. 61/64 in.

MODULE OF INSTRUCTION
FOR
AVIATION MAINTENANCE TECHNOLOGY

GENERAL
G101 MATHEMATICS AND PHYSICS
SOLVE PROBLEMS USING PRINCIPLES OF PHYSICS
G101-B



GENERAL
G101 MATHEMATICS AND PHYSICS
SOLVE PROBLEMS USING PRINCIPLES OF PHYSICS
G101-B

MODULE CONTENTS

A. Introduction and Module Objective

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INTRODUCTION

Knowledge of basic physics helps us understand laws which determine the operation of our engines, the transmission of power by our electrical and hydraulic systems, and the flight of our aircraft. As a result, we are able to design repairs for aircraft that will give them necessary strength for flight.

MODULE OBJECTIVE

After completion of this module, you will be able to solve problems relating to the nature of matter, energy, work, force, motion, heat, pressure, gas laws, fluid mechanics, and sound. You will demonstrate this knowledge by completing the procedures outlined in the workbook assignments. You will further demonstrate this knowledge by scoring 85 percent on the module theory test.

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SPECIFIC OBJECTIVES

After completion of this module, you will be able to

1.	Match terms related to principles of physics to their correct definitions. (1)	Technical Supplement #1	
2.	Describe the physical and chemical nature of matter. (1)	EA-ITP-G EA-ITP-GW	1:II:47-52 1:II:22-23
3.	List the three states of matter. (1)	EA-ITP-G EA-ITP-GW	1:II:47-52 1:II:22-23
4.	Discuss potential and kinetic energy. (1)	EA-ITP-G EA-ITP-GW	1:III:53-54 1:II:23
5.	State the formulas for work and power. (1)	EA-ITP-G EA-ITP-GW	1:IV:55-56 1:II:23-24
6.	Explain power. (1)	EA-ITP-G EA-ITP-GW	1:V:56 1:II:24
7.	Explain the basic purpose for using practical machines. (1)	EA-ITP-G EA-ITP-GW	1:VI:57-63 1:II:24-26
8.	Solve problems related to levers. (2)	EA-ITP-GW	1:II:24-26
9.	Discuss the relationship between stress and strain. (1)	EA-ITP-G EA-ITP-G	1:VII:63-64 1:VIII:65
10.	List five types of stress. (1)	EA-ITP-G EA-ITP-GW	1:VII:63-64 1:II:27
11.	State Newton's Laws of Motion. (1)	EA-ITP-G EA-ITP-GW	1:IX:66-67 1:II:27
12.	State the difference between speed and velocity relative to bodies in motion. (1)	EA-ITP-G EA-ITP-GW	1:IX:67-68 1:II:27
13.	Discuss the relationship between heat and energy. (2)	EA-ITP-G EA-ITP-GW	1:X:69 1:II:28

14.	List and explain the three methods of heat transference. (2)	EA-ITP-G EA-ITP-GW	1:X:70-72 1:II:28
15.	List, give the abbreviation, and explain the use of the four common temperature scales. (2)	EA-ITP-G EA-ITP-GW	1:X:71-72 1:II:28
16.	Convert temperatures between common temperature scales. (2)	EA-ITP-G EA-ITP-GW	1:X:71-72 1:II:28
17.	State standard sea-level barometric pressure. (1)	EA-ITP-G EA-ITP-GW	1:XI:73 1:II:29
18.	List and discuss the three types of pressure. (1)	EA-ITP-G EA-ITP-GW	1:XI:73-74 1:II:29
19.	State the formula for the general gas law. (1)	EA-ITP-G	1:XII:76
20.	Calculate pressure and volume of gases. (2)	EA-ITP-G EA-ITP-GW	1:XII:76 1:II:29-30
21.	State Pascal's Law and Bernoulli's Principle. (1)	EA-ITP-G	1:XIII:80-83
22.	Calculate force from pressure and area in a hydraulic cylinder. (2)	EA-ITP-G EA-ITP-GW	1:XIII:81-82 1:II:30-31
23.	Solve problems in fluid mechanics related to Pascal's law. (2)	EA-ITP-G EA-ITP-GW	1:XIII:80-82 1:II:31
24.	Discuss mach number and its relationship to temperature. (1)	EA-ITP-G EA-ITP-GW	1:XIV:84-87 1:II:32

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INSTRUCTOR'S MODULE IMPLEMENTATION GUIDE

I. Order materials to supplement module--Videotapes:

A. Temperature, Pressure, and Fluids, ITP-G1, Program 4, Part 1 - Gases.

B. Temperature, Pressure, and Fluids, ITP-G1, Program 4, Part 2 - Liquids.

C. Energy, Work, Power, and Force, ITP-G1, Program 2.

D. Newton's Laws of Motion, ITP-G1, Program 3.

E. Bernoulli's Principle - Why An Airplane Flies, ITP-G1, Program 5.

F. Sound and Its Effects, ITP-G1, Program 6.

(Note: These videotapes are available from Aviation Maintenance Publishers, Inc., P.O. Box 36, 1000 College View Drive, Riverton, Wyoming 82501.)

II. Implementation Suggestions

Estimated Teaching Time		Theory	Lab
Objective 1	Explain the importance of physics to the aviation maintenance technician. Explain terms related to the principles of physics.		
Objectives 2-3	Discuss and have students complete EA-ITP-GW, Part II, pages 22-23.		
Objectives 4-6	Discuss and have students complete EA-ITP-GW, Part II, pages 23-26. Show videotape ITP-G1, Program 2, Energy, Work, Power, and Force.		
Objectives 7-8	Explain and discuss force and levers. Have students complete EA-ITP-GW, pages 24-26.		
Objectives 9-10	Discuss the five types of stress and the meaning of strain. Have students complete EA-ITP-GW, Part II, page 27.		

Estimated Teaching Time		Theory	Lab
Objectives 11-12	Discuss and have students complete EA-ITP-GW, Part II, page 27. Show videotape ITP-G1, Program 3, Newton's Laws of Motion.		
Objectives 13-16	Discuss and have students complete EA-ITP-GW, Part II, page 28. Assist as necessary.		
Objectives 17-18	Discuss and have students complete EA-ITP-GW, Part II, page 29.		
Objectives 19-20	Discuss and have students complete EA-ITP-GW, Part II, pages 29-30. Show videotapes ITP-G1, Program 4 Temperature, Pressure, and Fluids, Part 1 - Gases and ITP-G1, Temperature, Pressure, and Fluids, Part 2 - Liquids.		
Objectives 21-23	Discuss and have students complete EA-ITP-GW, Part II, pages 30-31. Show videotape ITP-G1, Program 5, Bernoulli's Principle - Why An Airplane Flies.		
Objective 24	Discuss sound movement and speed and have students complete EA-ITP-GW, Part II, page 32. Show videotape ITP-G1, Program 6, Sound and Its Effects.		

TECHNICAL INFORMATION SUPPLEMENT #1 - Terms and Definitions

A. Atom - Smallest particle of an element; consists of a positively charged nucleus orbited by one or more negatively charged electrons

B. Element - Chemical substance that cannot be divided into simpler substances by chemical means

C. Molecule - Smallest particle of a compound that retains its chemical identity

D. Compound - New entity formed by a union of elements or parts; the original elements lose their identity and assume the characteristics of the compound

E. Particle - One of the minute subdivisions of matter

Examples: Atom, molecule

F. Nucleus - Center of the core of an atom; consists of positively charged protrons and uncharged neutrons

G. Electron - Most basic particle of an atom with a negative charge; it spins around the nucleus and may move from one atom to another

(NOTE: Electrons that travel in this manner are called free electrons.)

H. Proton - Positively charged particle in the nucleus of an atom

I. Neutron - Uncharged particle in the nucleus of an atom; its mass is approximately that of a proton

J. Solid - Geometric figure which has three dimensions: length, width, and height. It is one of the three states of matter, with a definite volume and shape, and is relatively firm and hard

K. Liquid - Fluid which will assume the shape of the container in which it is held, but will not expand to completely fill the container

L. Gas - Fluid which will assume the shape of the container in which it is placed and will expand to fill all of the container

M. Weight - Force by which a body is attracted by gravity toward the center of the earth; equal to the mass of the body times the acceleration due to gravity

N. Mass - Measure of the amount of material contained in a body

O. Density - Mass of a substance per unit of its volume; weight per unit volume is expressed in pounds per cubic foot

P. Energy - Capacity for doing work

Q. Work - The product of force and the distance through which the force acts

R. Power - Time-rate of doing work; force times distance, divided by time

S. Force - Energy which tends to cause a motion or change

T. Lever - Rigid piece that transmits and modifies force or motion when forces are applied at two points and it turns about a third

U. Radiation - Energy emitted in the form of waves or particles

V. Convection - Transfer of heat energy from one place to another by circulatory movement of a mass of fluid

W. Conduct - To have the quality of transmitting light, heat, sound, or electricity

X. Absolute pressure - Pressure measured relative to zero pressure of a vacuum on an aneroid-type gage; often measured in inches of mercury

Example: Manifold pressure

Y. Gage pressure - Pressure above atmospheric as read out on a bourdon-tube gage; expressed in psig

Z. Differential pressure - Difference between two pressures

AA. Venturi - Specially shaped restrictor in a fluid-flow passage, used to increase the velocity of the fluid and decrease its pressure

BB. Mach number - Ratio of the speed of an airplane to the speed of sound in the same atmospheric conditions

CC. Stress - Force within a body that opposes any external action

DD. Strain - Deformation caused by a stress exceeding the elastic limit of a body

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THEORY TEST

1. Match terms related to principles of physics to their correct definitions. Write the correct numbers in the blanks.

_____a.	To have the quality of transmitting light, heat, sound, or electricity	1. Lever
_____b.	Energy emitted in the form of waves or particles	2. Radiation
_____c.	One of the minute subdivisions of matter	3. Mach number
_____d.	Rigid piece that transmits and modifies force or motion when forces are applied at two points and it turns about a third	4. Mass
_____e.	Smallest particle of an element; consists of a positively charged nucleus orbited by one or more negatively charged electrons	5. Atom
_____f.	Ratio of the speed of an airplane to the speed of sound in the same atmospheric conditions	6. Solid
_____g.	Geometric figure which has three dimensions: length, width and height. It is one of three states of matter, with a definite volume and shape, and is relatively firm and hard	7. Conduct
_____h.	Measure of the amount of material contained in a body	8. Particle
_____i.	Time-rate of doing work; force times distance, divided by time	9. Power
_____j.	Fluid which will assume the shape of the container in which it is held, but will not expand to completely fill the container	10. Liquid

_____k. Smallest particle of a compound that retains its chemical identity

_____l. Fluid which will assume the shape of the container in which it is placed and will expand to fill all of the container

_____m. The product of force and the distance through which the force acts

_____n. Specially shaped restrictor in a fluid-flow passage, used to increase the velocity of the fluid and decrease its pressure

_____o. Mass of a substance per unit of its volume; weight per unit volume is expressed in pounds per cubic foot

_____p. Energy which tends to cause a motion or change

_____q. Force by which a body is attracted by gravity toward the center of the earth; equal to the mass of the body times the acceleration due to gravity

_____r. Capacity for doing work

_____s. Transfer of heat energy from one place to another by circulatory movement of a mass of fluid

_____t. Difference between two pressures

_____u. Most basic particle of an atom with a negative charge; it spins around the nucleus and may move from one atom to another

_____v. Pressure above atmospheric as read out on a bourdon-tube gage; expressed in psig

11. Venturi
12. Force
13. Gas
14. Energy
15. Molecule
16. Convection
17. Differential pressure
18. Density
19. Weight
20. Work
21. Electron
22. Gage pressure

_____w . Positively charged particle in the nucleus of an atom

_____x. Pressure measured relative to zero pressure of a vacuum on an aneroid-type gage; measured in inches of mercury

_____y. Uncharged particle in the nucleus of an atom; its mass is approximately that of a proton

_____z. Center of the core of an atom; consists of positively charged protons and uncharged neutrons

_____aa. New entity formed by a union of elements or parts; the original elements lose their identity and assume the characteristics of the compound

_____bb. Chemical substance that cannot be divided into simpler substances by chemical means

_____cc. Deformation caused by a stress exceeding the elastic limit of a body

_____dd. Force within a body that opposes any external action

23. Neutron
24. Element
25. Compound
26. Absolute pressure
27. Nucleus
28. Proton
29. Stress
30. Strain

2. Describe the physical and chemical nature of matter.

   a. Chemical--_____

   _____

   b. Physical--_____

   _____

3. List the three states of matter.

   a. _____

   b. _____

   c. _____

4. Discuss potential and kinetic energy.

   a. Potential--_____

   _____

   b. Kinetic--_____

   _____

5. State the formulas for work and power.

   a. Work--_____

   b. Power--_____

6. Explain power.

   _____

   _____

   _____

7. Explain the basic purpose for using practical machines.

   _____

   _____

   _____

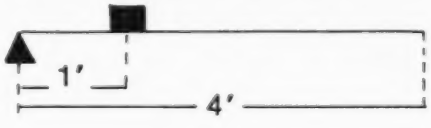
8. Solve the following problems related to levers. Refer to the formula page at the end of the test.

   a. The arm of lever A is 8 ft. long. The fulcrum is located 3 ft. from the load to be lifted. The load weighs 500 lbs. How much effort is needed to lift this weight?

   _____ lbs.

   b. A wheelbarrow is loaded with 100 lbs. of rock. How much force is required to lift that load, if the grips of the handles are 4 ft. from the axle and the center of the load of rock is located one foot from the axle?

   _____ lbs.



9. Discuss the relationship between stress and strain.

10. List five types of stress.

    a.

    b.

    c.

    d.

    e.

11. State Newton's Laws of Motion.

    a. Newton's first law -

    b. Newton's second law -

c. Newton's third law -

_____

_____

_____

_____

_____

12. State the difference between speed and velocity relative to bodies in motion.

_____

_____

_____

13. Discuss the relationship between heat and energy.

_____

_____

14. List and explain the three methods of heat transference.

a._____

_____

b._____

_____

c._____

_____

15. List, give the abbreviation, and explain the use of the four common temperature scales.

a._____

_____

b._____

_____

c._____

_____

d._____

_____

16. Convert the following temperatures. Refer to the formula page at the end of the test.

    a. $60^{\circ}F$ to _____ $^{\circ}C$

    b. $70^{\circ}C$ to _____ $^{\circ}F$

    c. $60^{\circ}C$ to _____ $^{\circ}K$

    d. $60^{\circ}F$ to _____ $^{\circ}R$

17. State standard sea-level barometric pressure.

    _____

18. List and discuss the three types of pressure.

    a._____

    _____

    b._____

    _____

    c._____

    _____

19. State the formula for the general gas law.

    _____

    _____

20. Calculate pressure and volume of gases.

    a. What will be the final temperature of a gas at $55^{\circ}C$ if its pressure is raised from 1,100 psig to 2,000 psig in a constant volume?
    _____ $^{\circ}C$

    b. What will be the final pressure when the temperature of a cylinder of oxygen at 250 psig is increased from $300^{\circ}F$ to $450^{\circ}F$?
    _____psig

    c. What will be the final volume of one liter of air when it is held at a constant pressure and its temperature is decreased from $40^{\circ}C$ to $10^{\circ}C$?
    _____liters

21. State Pascal's Law and Bernoulli's Principle.

    a. Pascal's Law--

    _____

    _____

    _____

    _____

    _____

    b. Bernoulli's Principle--

    _____

    _____

    _____

    _____

    _____

22. Calculate force from pressure and area in a hydraulic cylinder for the following problem. Refer to the formula page at the end of the test.

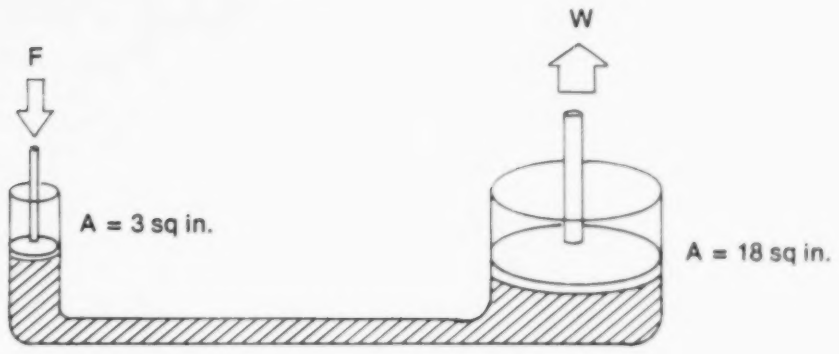
    a. 10 sq in. with 150 psi = _____ in. lbs

    b. 2 sq in. with 420 psi = _____ in. lbs

    c. 20 sq in. with 20 psi = _____ in. lbs

    d. What is the Delta/Tee formula used to solve the above problems?

23. Solve problems in fluid mechanics related to Pascal's Law. Refer to the following diagram to answer the following questions.



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a. How much weight may be lifted by a force of six pounds?
_____pounds

b. When the force piston is moved down six inches, how far will the weight piston move?
_____pounds

24. Discuss mach number and its relationship to temperature.

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FORMULAS FOR THEORY TEST

$^{o}F = 9/5\,^{o}C + 32$

$^{o}C = 5/9\,(^{o}F - 32)$

$^{o}R = {}^{o}F + 460$

$^{o}K = {}^{o}C + 273$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$V = A \times D$

$A = \pi r^2$

$C = 2\pi r$

$V = 4/3\,\pi r^3$

$F = P \times A$

$$\frac{W}{F} = \frac{f}{a}$$

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ANSWERS TO THEORY TEST

1.

a.	7	k.	15	u	21
b.	2	l.	13	v.	22
c.	8	m.	20	w.	28
d.	1	n.	11	x.	26
e.	5	o.	18	y.	23
f.	3	p.	12	z.	27
g.	6	q.	19	aa.	25
h.	4	r.	14	bb.	24
i.	9	s.	16	cc.	30
j.	10	t.	17	dd.	29

2. a. Chemical--Anything that occupies space

   b. Physical--The amount of electron molecule motion determines the physical state of matter

3. a. Solid
   b. Liquid
   c. Gas

4. Discussion should include the following

   a. Potential--Energy stored in a material due to its position or configuration

   b. Kinetic--Potential energy released in such a way that it causes motion

5. a. Work = Force x Distance

   b. Power = $\frac{\text{Force x Distance}}{\text{Time}}$

6. The time-rate of doing work

7. Practical machines are used to gain a mechanical advantage which will change the amount of force required to move an object

8. a. $\frac{W}{F} = \frac{f}{a}$ $\qquad 5F = 500$

   $\frac{500}{F} = \frac{5}{3}$ $\qquad a = 300$ lbs.

b. $\frac{W}{F} = \frac{f}{a}$

$\frac{100}{F} = \frac{4}{1}$

$4F = 100$

$F = 25$ lbs.

9. Discussion should include the following

Stress is a force within a body to resist an applied external force. When the stress exceeds the elastic limit of the body, the body is strained

10. a. Tension
    b. Compression
    c. Torsion
    d. Bending
    e. Shear

11. a. Newton's first law--A body at rest will remain at rest and a body in motion will remain in motion in a straight line unless acted on by an outside force

    b. Newton's second law--Acceleration of a mass by a force is directly proportional to the force and inversely proportional to the mass

    c. Newton's third law--For every action there is an equal and opposite reaction

12. Speed is a rate of motion, whereas, velocity is the rate of motion in a given direction

13. Discussion should include the following

Heat is a form of energy associated with the motion of molecules within a material

14. a. Conduction--Heat will transfer from the body having the highest level of energy to the one having a lower level of energy

    b. Convection--Heat is absorbed by a free-moving fluid, either liquid or gas

    c. Radiation--Heat using vibratory or wave motion within the molecules it strikes

15. a. Celsius scale, ^{o}C
    Water freezes at $0^{o}C$ and boils at $100^{o}C$

    b. Kelvin scale, ^{o}K
    Water freezes at $273^{o}K$ and boils at $373^{o}K$

c. Rankine scale, $^{\circ}R$
Water freezes at $492^{\circ}R$ and boils at $212^{\circ}R$

d. Fahrenheit scale, $^{\circ}F$
Water freezes at $32^{\circ}F$ and boils at $212^{\circ}F$

16. a. $60^{\circ}F$ to $15.6^{\circ}C$
b. $70^{\circ}C$ to $158^{\circ}F$
c. $60^{\circ}C$ to $333^{\circ}K$
d. $60^{\circ}F$ to $520^{\circ}R$

17. 29.92 in. of mercury

18. a. Absolute pressure - Measured from zero pressure or a vacuum

b. Gage pressure - Pressure above the barometric pressure (outside pressure)

c. Differential pressure - Difference between two pressures

19. $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$

20. a. $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$ $\quad \frac{1100}{55} = \frac{2000}{X}$ $\quad 1100X = (55)(2000)$ $\quad X = \frac{110000}{1100} = 100^{\circ}C$

b. $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$ $\quad \frac{250}{300} = \frac{X}{450}$ $\quad 300X = (250)(450)$ $\quad X = \frac{112500}{300} = 375$ psig

c. $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$ $\quad \frac{1}{40} = \frac{X}{10}$ $\quad 40X = 10$ $\quad X = \frac{10}{40} = 0.25$ liters

21. a. Pascal's Law - An increase in pressure at any point in a confined fluid will produce an equal increase in pressure at every point in the liquid; pressure will always act at right angles to the container that encloses the liquid

b. Bernoulli's Principle - When energy is neither added to nor taken from a fluid in motion, the pressure will decrease when the flow is increased

22. a. $10 \times 150 = 1{,}500$ in. lbs

    b. $2 \times 420 = 840$ in. lbs

    c. $20 \times 20 = 400$ in. lbs

    d. $\frac{F}{A}$ P

23. a. $F = P \times A$ P $F/A = \frac{6 \text{ lbs.}}{3 \text{ sq in.}} = 2$ psi

    $F_W = P \times A$ $F_W = (2 \text{ psi})\ (18 \text{ sq in.}) = 36$ lbs

    b. $V_1 = A_1 \times D_1$ $V_1 = (3 \text{ sq in.})\ (6 \text{ in.}) = 18 \text{ in.}^3$

    $V_2 = A_2 \times D_2$ $D_2 = V_2/A_2$ $[V_1 = V_2]$ $D_2 = \frac{18 \text{ in.}^3}{18 \text{ sq.in.}} = 1$ inch

24. Discussion should include the following--The mach number is the ratio of the speed of the aircraft to the speed of sound; the speed of sound decreases as the altitude increases and the temperature drops